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THE AMERICAN
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VOL. 99 OCTOBER, 1927 NO. 10

# EDITORIAL

## BRITAIN'S CORNER DRUG STORE

WHETHER the doctor be vacationing on the Riviera—or hunting in the Maine woods or parading the planks in Atlantic City—always when he meets a kindred soul he never misses his chance to "talk shop"—of patients who died for no reason at all—of postmortems that revealed what the antemortems did not, and of odd kidneys and huge hearts and other sorts of anatomical rare and spare parts. Indeed the average doctor is so case hardened that vacationing as an ordinary mortal is beyond his power—the "doctor" will out.

In some measure this may be true of all of us—whether we be doctors or lawyers—chemists or druggists—painters or plumbers. And it is not strange that the work which surrounds us the great part of the time should refuse to be discarded totally during the brief term of our holiday.

And so it was with this Editor during an European vacation just brought to a close.

In London and Paris—in Brussels and in Turin—there were sights that will be long remembered

He saw and marvelled at ancient buildings, the monuments, the churches, the castles. Among an array of spoils, and in a splendid tomb he was shown in Paris where the great Napoleon rests. Close by, in a state somewhat less splendid, is Pasteur's holy burial place. But what a beautiful sentiment hovers about his sepulchre, what a significance, what majesty is in the sculpture of four great white angels, Faith, Hope, Love and Science, watching silently over their sleeping son!

But we are wandering from the text. What we purposed to write was that in spite of all these splendid attractions, the urge came along

consistently—and we consistently listened to it—to steal away quietly to talk shop with someone who would talk with us.

In Bethesda, Wales, leaving the heather dressed hills awhile, into a snug little chemist's shop the editor ambled—a little shop he knew right well many years ago. The proprietor was glad to "talk shop" with him and to renew old contacts. Quite a prosperous establishment he presided over, and quite a happy conversation we had on odds and ends of subjects.

But he had it in for "American Pharmacy." Standing behind a counter, packed with hair-nets and goggles and camera supplies—he reproached the American drug store for its commercialism.

He said that, once, before the chain store, which he blamed on American enterprise, came to Britain, his business was a profession—but now his profession has demoralized to a mere business.

It was "Boots, Boots, Boots"—as Kipling might have written. "Imagine," he said, "an American tourist actually had the nerve to ask me did I carry postage stamps?"

"How ridiculous"—we said—and he looked at us and wondered how to interpret the comment.

Had he stared hard enough he too might have seen what the editor was seeing in his mind just then—a windowful of silk stockings—or the two pounds of coffee for fifty-one cents, or the steaming roast beef sandwich—all in front of a prescription counter or in back of a drug store sign.

But he said, "Yes—the old state of things is gone forever."

Yet in spite of our sentimental leanings toward the *old state* of things, it could not be denied that our friend's little shop had a snap to it, such as it had never shown in other years. His business was prosperous—and he himself was so unlike the morbid, but kind and venerable gentleman who before him presided over the glum and gloomy establishment which as a boy we often visited.

Elsewhere in Great Britain, particularly in the larger cities, one sees evidences of the same kind of a change. The drug stores are cleaner and there is a vigor to their business. Murkiness and mystery no longer serve as assets—the modern drug store is spick and span.

(In France and in Belgium the germ of modernism is equally busy, although there will be more resistance to it there.)

On the whole, we felt that our Welsh friend was fairly sure of his ground when he said that "American Pharmacy had successfully invaded Great Britain."

If we judge by the present, it has been Britain's gain—for the evolution of the staid British drug store into the vigorous business establishment which it generally is today, has brought with it much temporal success and prosperity. But whether British Pharmacy is selling its birthright for a mess of pottage only the future will prove.

IVOR GRIFFITH.

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# ORIGINAL ARTICLES

## THE EXISTENCE OF MENTHONE IN THE ENOL FORM†

**By Samuel M. Gordon***

IT IS WELL KNOWN that certain organic compounds are readily isomerized and therefore exist in several forms. The classical example of such a rearrangement is ethyl-aceto-acetate, which may exist as ethyl ester of Keto-3-butane acid 1, or of butene-2-ol-3-acid 1. K. H. Meyer [1] has carefully determined the conditions under which each form is stable. Under ordinary conditions aceto-acetic ester is presumed to be an equilibrium mixture of the two "forms."

The phenomenon of "dynamic equilibrium" is not restricted to the so-called aliphatic compounds, but is also found in the aromatic compounds. Phloroglucinol, as is well-known, reacts both as a trihydroxy compound or as a tri-keto compound, as shown by the formation of a tri-acetate or a tri-oxime.[2]

More recently Evans and Nicoll [3] have shown that acetone may also exist in two forms, acetone and iso-acetone—the amount of the enol form being a function of the NaOH present.

The reaction is then seen to be of a general nature, but the conditions within the molecule, favorable for such a phenomenon are the presence of adjacent methylene, methylidene and keto groups.

†Contribution from the Laboratory of Plant Chemistry, University of Wisconsin.

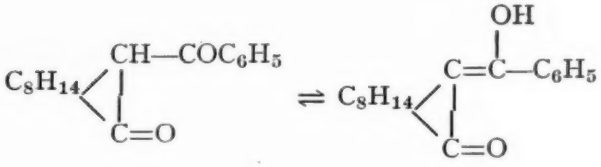
*Wrigley Fellow 1924-1926.

[1] Ber. 45, 2846 (1912).

[2] Ber. 19, 159 (1886).

[3] J. A. C. S. 47, 2789 (1925).

The conditions have long been known to be theoretically possible for ketones of the terpene series, as evidenced by the structural formulæ of menthone, pulegone, camphor and the like. Benzoyl camphor is known to exist in two desmotropic forms:



Dimroth [4] has shown that the stability of each of the forms is influenced by the nature of the solvent. The enolization in this compound, however, does not involve the carbonyl group of the camphor residue. It is only in recent times that evidence has been brought forward to show that the ketone group in "terpene" residues can undergo such a rearrangement. Grignard and Savard [5] have advanced evidence, both of a physical and a chemical nature, showing the tautomerization of pulegone ($\Delta^{4\,[8]}$ menthene-one-3) into an alcohol of the menthadiene series, $\Delta^{2,4\,[8]}$ menthadiene-ol-3. From the enol form there were prepared a number of alkyl ethers, thus convincingly showing the existence of pulegone in the enol form.

The change of optical rotation of menthone when treated with acids at low temperature is well known. Beckmann [6] assumed that the change in the angle of rotation brought about by acids is due to intermediary enolization. The interpretation is favored by the observation made by Mannich and Hancu [7] that l-menthone ($[\alpha_D]$ —22.4°) when subjected to prolonged heating with acetic acid anhydride at 240° in a sealed tube yields the ester of 1-methyl-4-methoethyl cyclohexene-(2 or 3)-ol-3, which upon saponification yields a dextrogyrate menthone ($\alpha_D$ + 1.54° in a 20 mm. tube).

The purpose of the present report is to record the apparent enolization of menthone at ordinary temperatures, and the possible significance of the reaction to esterification in plants.

[4] Ann. 377, 134 (1910).
[5] C. R. 181, 589 (1925).
[6] Ann. 250, 366 (1888).
[7] Ber. 41, 570 (1908).

Esterification in plants is commonly ascribed to the action of enzymes. That in the case of saw-palmetto berries this interpretation was not necessary was shown by C. H. Mann.[8] His experiments with ethyl alcohol and fatty acids was duplicated with menthol. Menthone, the dehydration product of the glycol, menthone di-ol 3, 3, being available this was also tried out, but whereas the mixtures were prepared in 1910, the quantitative determinations were made only recently.

## Experimental

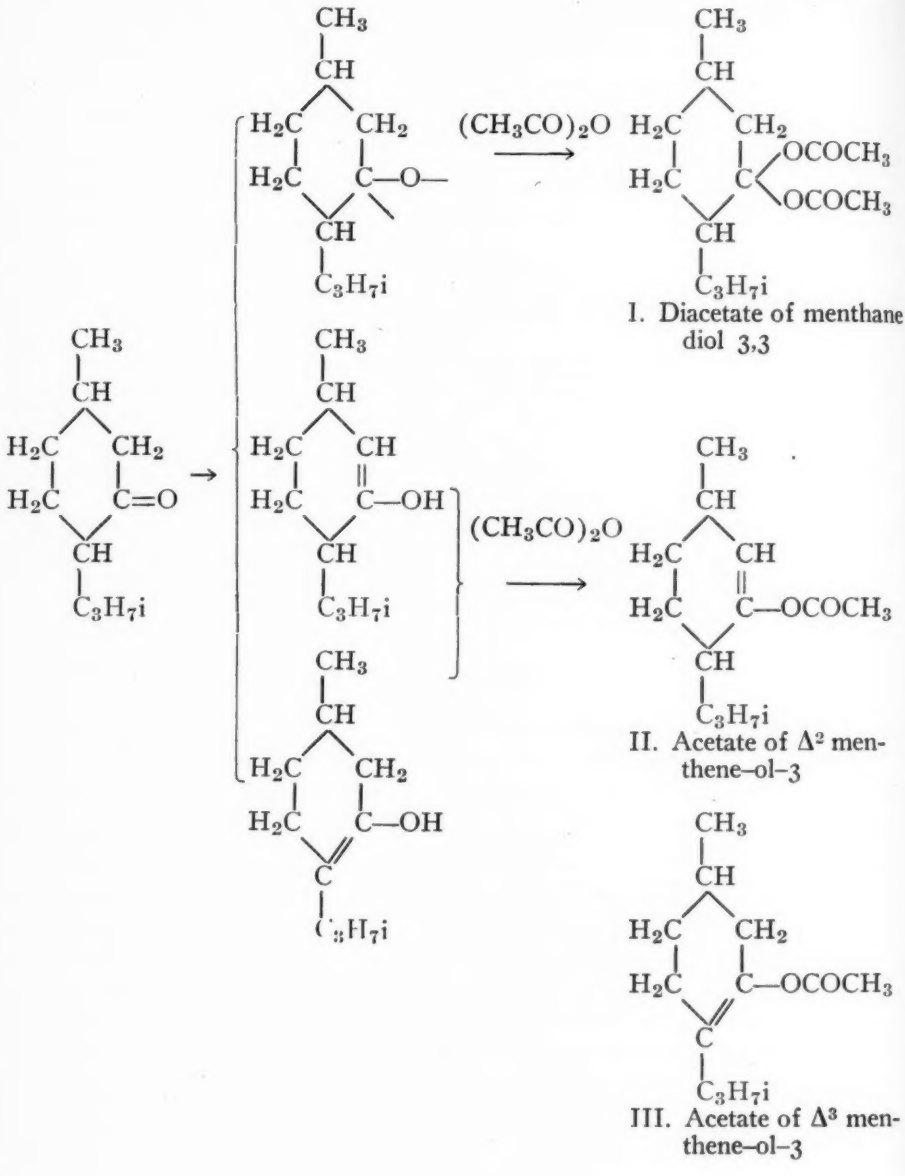
Three of the mixtures prepared in 1910, containing varying molecular quantities of menthone and acetic anhydride were analyzed for the amount of ester present. The acid mixtures were well washed with water, with 10% $Na_2CO_3$ solution and again with water until neutral to litmus, and finally dried over anhydrous $Na_2SO_4$. Weighed quantities were saponified according to the standard method with n/2 alcoholic KOH. The per cent of esters were computed directly from the ester values by reference to the tables in Gildermeister-Hoffmann, Die Aetherische Ole, Vol. I (1910).

| Menthone | Anhydride | Mol. props. | Ester Value | % Ester as[9] $C_{10}H_{19}OCOCH_3$ |
|---|---|---|---|---|
| 200 gms. | 77. gms. | 1:1 | 49.78 | 14.41 |
| 150 | 174.7 | 1:1.75 | 6.13 | 2.51 |
| 100 | 116.6 | 1:3 | 5.75 | 2.02 |

From the analytical data it is readily apparent that an enolization had taken place; and that the amount of enolization is a function of the ratios of menthone and acetic anhydride. Equimolecular amounts favor the inversion of the keto to the enol form. Yet, a consideration of the theoretical possibilities indicates other reactions besides the assumption already made. Menthone in the presence of acetic anhydride may react in several ways:

[8] Bull. of the Univ. of Wisconsin, No. 767 (1915).

[9] The ester content was calculated as menthyl acetate instead of for menthenyl acetate, the difference being very slight.




I. Diacetate of menthane diol 3,3

II. Acetate of $\Delta^2$ menthene–ol–3

III. Acetate of $\Delta^3$ menthene–ol–3

The most likely conclusion as to the nature of the resulting ester is that it is either II or III.[10]

Other work has made it impossible to continue the study of this reaction, hence this brief report is made at this time.

**Summary**

1. Menthone in the presence of acetic anhydride is apparently enolized to the corresponding unsaturated alcohol.

2. The amount of enolization is a function of the molecular ratios of the ketone and the anhydride.

*Madison, Wisconsin.*

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## THE FIFTH ANNUAL PLANT SCIENCE SEMINAR

### MISSOURI BOTANICAL GARDENS

### St. Louis, Mo., August 16-19, 1927

ALL SESSIONS of the Fifth Annual Plant Science Seminar, August 16-19, were held at the Missouri Botanical Gardens. Beside the St. Louis members, twenty-eight members from outside of St. Louis were in attendance and at the more popular evening sessions a large number of St. Louis people were also present.

Among the members present were representatve pharmacognosists from all parts of the country, including several who had not before attended any of the Seminars.

The object of the Seminar is threefold: First, acquaintanceship and fellowship—learning to know our professional contemporaries and to work with them; second, learning by doing—laboratory demonstrations in which everyone takes a part, round tables and field trips were important features of the Seminar; third, stimulation of research in connection with pharmacognosy and plant chemistry. Committees of the National Research Council and of the National Conference of Pharmaceutical Research met during the Seminar.

The results accomplished in the Seminar may be summarized as follows:

[10] Mannich and Hancu, ref. 7.

**ATTENDING THE PLANT SCIENCE SEMINAR—St. Louis, August 16-17, 1927.**

**First Row, Left to Right—Dr. Albert Schneider, Dr. E. J. Petry, Dr. G. L. Keenan, Prof. E. H. Wirth, Prof. C. M. Sterling, Miss Esther Meyer, Mr. P. D. Carpenter, Dr. H. W. Youngken, Mr. H. A. Nelson, Prof. Otto P. M. Canis, Secretary, Prof. E. N. Gathercoal, Chairman, Mrs. A. R. Crawford, Mrs. L. K. Darbaker and Prof. L. K. Darbaker.**

**Second Row, Left to Right—Prof. Earl Fischer, Prof. M. S. Dunn, Dr. C. C. Plitt, Mrs. C. C. Plitt, Prof. L. Smith, Prof. Leo Suppan, Dr. R. V. LeGarde, Mr. S. W. Owen, Prof. Anton Hogstad. Jr., Mr. John H. Kellogg and Prof. E. Fullerton Cook.**

*First.*—The Committee on Pharmaceutical Botany and Pharmacognosy of the National Research Council has been in close fellowship and active co-operation with the Seminar. This year the report of Dr. W. W. Stockberger on the survey of native drug resources was presented by Dr. Youngken owing to the illness of Dr. Stockberger. The report indicates that excellent progress is being made on the survey in the following localities: New Jersey, western New England, Pacific Coast and the Carolina Mountains. At least two years more will be required to complete the survey. The importance of this survey cannot be overestimated and fully justifies the immense amount of work and the considerable expense involved in its completion. The Seminar is requested to again appeal to the State Pharmaceutical Associations for funds to continue this work.

*Second.*—The Seminar has again undertaken constructive work in connection with U. S. P. revision. At the request of the Chairman of the U. S. P. Revision Committee, Prof. E. H. Wirth prepared a report on "The Pharmacognosy of the New German Pharmacopœia in Comparison with U. S. P. X," and a committee consisting of Professors E. L. Newcomb, Albert Schneider, E. H. Wirth, H. W. Youngken and E. N. Gathercoal presented a study of the histological terms of U. S. P. X. The acceptance by the Executive Committee of the U. S. P. Revision Committee of Dr. Youngken's offer to prepare a glossary of histological terms was heartily approved and the following general principles were adopted to serve as a guide to Dr. Youngken in this work:

1. We believe that a single specific term should be used to designate each histological structure, but that a conservative use of homonyms for literary effect is permissible.

2. We advocate the use of modern scientific terms of simple construction wherever possible.

3. This glossary when approved by the Plant Science Seminar is to be recommended as a guide to the sub-committee on Botany and Pharmacognosy of the Revision Committee of U. S. P. XI, the Revision Committee of N. F. VI, and authors of textbooks and original articles using histological terms.

*Third.*—This year the Seminar definitely recognized the deep interest of its members in the teaching of Pharmacognosy by accord-

ing a place on its program to a round table led by Professor Anton Hogstad on this subject. There was a broad interchange of opinion and while it is recognized by all that every one must teach according to his individual abilities, yet the impress of the various ideas advanced cannot fail to broaden and influence each one present. A splendid talk by Professor E. Fullerton Cook on his personal impressions of the dean of Pharmacognosists, Dr. A. Tschirch of Berne, Switzerland, as a man and a teacher, preceded the discussion.

*Fourth.*—The apparent discrepancies in U. S. P. and N. F. abbreviations as presented by Dr. C. C. Plitt led the Seminar to suggest that he investigate actual abbreviations as used in physicians' prescriptions and report a tabulation of his findings at the Sixth Annual Seminar.

*Fifth.*—A practical demonstration by Dr. George L. Keenan on "Microchemistry and the Polarizing Microscope in Qualitative Analysis" led to a request from the Seminar for volunteers to apply Dr. Keenan's methods to various problems in pharmacognosy, including the determination of the composition of the spheroidal crystals of belladonna Professors L. K. Darbaker, M. S. Dunn and Albert Schneider volunteered to employ this method and report their findings at the next Seminar.

Friday was devoted to an inspection of the splendid orchid collection, second to none in the world, at Gray Summit, where the Missouri Botanical Gardens have a beautifully located 1600-acre wild tract. Dr. G. H. Pring preceded the inspection with a talk on his work in the collection and growing of orchids, which together with the welcoming address of Dr. George T. Moore, Director of the Gardens, on the activities of the Missouri Botanical Gardens, gave us a splendid conception of the organization and administration of this memorial to the founder of the Gardens, Henry Shaw.

This report, cannot be completed without mentioning the truly splendid illustrated lecture by Mr. L. J. Schwarz on "Cocoa Production in Africa"; the marvelous moving pictures prepared and presented by Mr. A. C. Pillsbury, showing the development of flowers and the production of pollen tubes; "Some Medical Aspects of Pharmacognosy," by Prof. Seward Owen; "Some Investigations of Hay Fever Pollen," by Dr. R. V. L. LaGarde; "A Recent Substitute for

Viburnum Prunifolium," by Dr. H. W. Youngken; "The Vaporator, an Instrument to be Used in Microdistillation and Microsublimation," by Dr. Arno Viehoever; "Standardization of Digitalis Solutions With Daphnia sps.," by Dr. Arno Viehoever; "The Message of Moses to the Pharmacist," by Prof. M. S. Dunn; "Some Recent Evidence of the Kinship Between Plants and Animals," by Dr. Albert Schneider.

The invitation of the directors of the Missouri Botanical Gardens and the unfailing courtesy of every one connected with the Gardens, together with the splendid co-operation and financial support of the local A. Ph. A. Committee and the efficient services of Professors Anton Hogstad and Seward Owen, as well as the generous and accurate publicity accorded us by the St. Louis press, all operated to make this Fifth Annual Seminar notably pleasant and successful.

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## THE PHARMACOGNOSY OF THE GERMAN PHARMACOPŒIA (6) AS COMPARED WITH THAT OF THE UNITED STATES PHARMACOPŒIA X *†

By E. H. Wirth

THE FOLLOWING report is the summary of a comparative study of the pharmacognosy of the new German Pharmacopœia (Deutsches Arzneibuch) which became official January 1, 1927, with that of the new United States Pharmacopœia official from January 1, 1926. Only such drugs have been included which occur on the market in approximately their original state having undergone no special process other than the ordinary drying, garbling or general purification. Cell contents such as volatile and fixed oils, and compounds of definite chemical structure such as alkaloids, camphor, menthol, etc., have not been included. Likewise such drugs as resin of jalap which require the application of a pharmaceutical process in their preparation have been excluded. Drugs as acacia, tragacanth, myrrh, rosin, balsam of Peru, etc., however have been included. Throughout the report the United States Pharmacopœia X will be indicated U. S. P. and the German Pharmacopœia 6, G. P.

*See reprint in *Jour. A. Ph. A.*, Vol. 16, page 281.
†Plant Science Seminar.

## Scope

One hundred thirty-four drugs occur in the G. P. against eighty-eight in the U. S. P. Of these sixty-three are official in both books (sixty-four of the G. P. drugs being in the U. S. P. due to the fact that starch is official in the G. P. in separate monographs, rice and wheat). This figure includes the same or similar drugs official under the same or similar titles but naturally some discrepancies arise as to botanical source, commercial varieties, etc., among which the following might be named. Amylum of the U. S. P. is corn starch while starch is official in the G. P. under two titles, Amylum Tritici and Amylum Oryzæ. Green Hellebore is official in the U. S. P. as Veratrum Viride while the white variety is official in the G. P. as Rhizoma Veratri. Differences in botanical source occur in such drugs as Strophanthus (U. S. P., *S. Kombe* and *S. hispidus* G. P., *S. gratus*) and Capsicum (U. S. P. *C. frutescens;* G. P. *C. annum*). Under Aloa the U. S. P. includes three commercial varieties, under Sarsaparilla three and under Krameria two, while in the G. P. only one variety is official in each of these cases. Difference in inclusion of plant parts also occur *i. e.,* Folia Belladonnæ G. P. includes leaves only while Belladonnæ Folia U. S. P. includes leaves and tops.

In the consideration of scope one must bear in mind that the Germans have no book corresponding to our National Formulary the fifth edition of which includes thirty-one drugs also found in the German Pharmacopœia.

The following statistical figures on scope have been compiled:

134 vegetable drugs official in the G. P.
64 of which are official in the U. S. P.
70 official in the G. P., not official in the U. S. P.

31 of which are included in the N. F. (5), leaving
39 official in the G. P. but not in either U. S. P. or N. F.

88 vegetable drugs are official in the U. S. P.
63 of which are official in the G. P.
25 official in the U. S. P. but not in the G. P.

Of the 144 vegetable drugs in the N. F. 113 are not in the G. P.

134 vegetable drugs official in the G. P.
232 vegetable drugs official in both American books (U. S. P. and N. F.)

Of the crude animal drugs (not including antitoxins, etc.) twelve occur in the G. P. against sixteen in the U. S. P., of which eleven are official in both books. Those official in the U. S. P. but not in the G. P. are Coccus, Fel Bovis, Pancreatinum, Pituitarium and Sevum Praeparatum, Mel depuratum being the only G. P. one not official in the U. S. P.

Deletions and additions are also of interest. Of the forty-five articles deleted by the 6th G. P. eleven were vegetable drugs, and of the 106 new articles added by the same book nine were vegetable drugs. One hundred ninety-two articles were deleted by the 10th U. S. P. of which thirty-five were vegetable drugs, while among the forty new articles added three were vegetable drugs.

The matter of scope of a pharmacopœia is after all an expression of the medical opinion of therapeutic value. Both the new German Pharmacopœia and the new United States Pharmacopœia seem to exhibit about the same trend towards such modern opinion and usage in prescription practice, the U. S. P. being (according to *Jour. A. M. A.*) the more critical. Of the thirty-nine G. P. drugs (see Table I) not official in the U. S. P. or N. F. few are probably ever prescribed in this country and of the twenty-five (see Table II) official in the U. S. P. but not in the G. P. the reverse is probably true.

Geographical distribution probably also plays an important part in the determination of usage as well as in moulding medical opinion, for example, Cascara so widely prescribed in this country is replaced by Frangula in the G. P. Among other U. S. P. drugs indigenous to America and hence probably rarely used in Germany are such as Cimicifuga, Serpentaria, Wild Cherry, Rhus Glabra, etc.

The scope of the two books is then quite similar. While the G. P. contains more vegetable drugs than the U. S. P. many of these have been relegated to the N. F. and the balance on either side represent quite well the factors of geographical distribution and local medical viewpoint.

## Monographs

In general form the monographs of both books are quite similar, *i. e.*, the sequence, official Latin title, common name, definition, microscopical, microscopical and powder descriptions, tests for identity and

purity, assay methods and dose, is followed in both. In contrast with the U. S. P. monograph printed in various sizes of type the G. P. monograph is printed in the same size Gothic type throughout, without sub-headings or paragraph captions. A comparative study of the monographs of the drugs occurring in both books reveals the following essential points of difference.

*Official Latin Title.*—In the U. S. P. this is printed in large capitals and occupies the entire line at the head of the monograph, while in the G. P. the first line includes besides the official Latin title (in Roman) the German title or common name (in heavy Gothic). In the statement of official Latin title the G. P. still adheres to the form of placing the plant part first as for example, Cortex Cinnamomi, Fructus Capsici, etc.

*Other Names.*—No other names are given in the G. P. except in certain instances P. l. titles. Where these occur they occupy the line below the official Latin title and are printed in smaller Roman. The U. S. P. gives English title, abbreviation and one or more common names.

*Standardization Rubric.*—Where a drug is assayed for percentage of active constituent a statement of minimum content required forms the first line of the monograph proper in the G. P. Other standardization requirements, such as extractives are found further along in the monographs, usually after the descriptions. Monographs of drugs not to be assayed begin with the definition. In the U. S. P. where standardization rubrics occur they follow the definition.

*Definition.*—The G. P. definitions are simliar to those of the U. S. P., the botanical names being printed in Roman and the botanist's names in italics. Specific names of plants are however much less capitalized than in the U. S. P. Family names are omitted in the G. P. and the definitions are usually a bit longer and more specific than those of the U. S. P., leaf drugs, for example, being usually directed to be gathered at the time of flowering. The G. P. definition does not form a complete sentence as does that of the U. S. P. which always begins with the English title followed by "is."

*Macroscopical Description.*—Macroscopical descriptions are quite similar in both books those of the U. S. P. being usually slightly longer, more specific and complete although as a rule the U. S. P. allows a greater margin in sizes. G. P. descriptions employ somewhat fewer technical terms. In contrast with the U. S. P. the G. P. descriptions often begin with the German title of the drug but have no sub-title, "Description and Physical Properties" or paragraph captions as do those of the U. S. P. The descriptions however are usually composed of a series of complete sentences.

Odor and taste are given in a separate paragraph and in a complete sentence beginning with the German title.

*Microscopical Description.*—Descriptions of structure are quite similar in content but differ somewhat as to form. Where the U. S. P. description usually consists of one incomplete sentence composed of several compact clauses the G. P. description is composed of a series of rather short and complete sentences. Sizes of cells, crystals, starch grains, etc., are given in the G. P. descriptions these usually being omitted from the U. S. P. structure descriptions. In the opinion of the writer the G. P. structure description, on account of its better language is easier to read and understand to the German pharmacist than is that of the U. S. P. to the American pharmacist although the U. S. P. description is usually longer, more complete and more specific.

Powder descriptions are usually brief in the G. P., the elements of identification only being mentioned and at times briefly described. Sizes of cell contents, etc., having been given under the structure description are not repeated. As before, the description is a complete sentence beginning with the name of the powder. U. S. P. powder descriptions are more complete and give sizes of starch grains, crystals, cells, etc.; here again in stating sizes the U. S. P. usually allows a greater margin.

In stating the size of starch grains the G. P. seems to employ the better method. Minimum sizes are often omitted and maximum sizes are given relatively, average sizes, however, being stated. Illustrating this point are the starch descriptions from the two Calumba monographs.

U. S. P. "individual grains 0.003 to 0.085 mm."

G. P. "mostly 25 to 50 $\mu$—seldom over 80 $\mu$ in size, etc."

The G. P. still adheres to the Greek letter mu for indicating microns which has been replaced by thousandths of a mm. in the U. S. P.

After a careful comparison of the microscopical descriptions of the sixty-three drugs occurring in both books the writer believes fewer errors in size, etc., occur in the U. S. P. than in the G. P. and greater accuracy in description is also evident in the former. The essential difference in the powder descriptions are that those of the U. S. P. are units in themselves while the G. P. ones are subsidiary to the structure description, in most cases.

*Identity Tests.*—Either following the powder descriptions or inserted between the macroscopic and microscopic descriptions of the G. P. are found identity tests corresponding to those of the U. S. P. In the monographs of the sixty-three drugs occurring in both books (see Table III) approximately sixty such tests are given in the G. P. against about forty in the U. S. P. Many of the tests are the same in both books the probably outstanding feature being the greater number of microsublimation tests in the G. P.

*Indications of, and tests for, Purity.*—The U. S. P., aside from the general notices in its introduction, frequently gives, following the definition, limits for acid insoluble ash, moisture and foreign organic matter. These are far less frequent in the G. P. and when they do occur are usually found after the powder description. Foreign organic matter is not mentioned in the G. P. In such drugs as belladonna leaf, hyoscyamus, etc., stems are directed to be absent. Moisture limits are given on a few drugs but acid-insoluble ash is absent (except in one case), total ash being substituted in its place. A total ash limit is given in each monograph and is expressed in hundredths of a gram per gram. On the other hand the G. P. indicates a number of adulterants, giving tests for them or describing their microscopical characteristics which it states, "must be absent from the powder." About 114 such tests are found in the monographs of the sixty-three drugs against about thirty-six in the U. S. P. (See Table III.)

*Standardization.*—Requirements for content of alkaloids, volatile oil, extractable material, etc., are about the same in both books,

(see Table III) the G. P. requirements being perhaps a bit more severe. On the other hand the U. S. P. establishes standards for a slightly greater number of drugs and indicates assay methods which are usually more accurate.

*Other Monograph Inclusions.*—The G. P. frequently directs that drugs be dried over burnt lime before powdering and also often indicates methods of preservation. These latter are given in the general notices in the U. S. P. preparations in which the drugs are to be used are not stated in the G. P. as they are in theU. S. P.

Doses are included less often in the G. P. than in the U. S. P. but where they are usually two, the maximum single dose and the maximum daily dose are given. With poisonous drugs, etc., the phrase "Vorsichtig aufzubewahren," (Precaution must be exercised) is printed at the end of the monograph. This latter, as well as the doses, are printed in a heavier Gothic than the monograph proper.

## General Assay Methods

In its introduction the G. P. gives methods for standardization of ocular micrometers, preparation of mounts, micro-sublimation, micro-distillation, the determination of volatile oil and the determination of ash in drugs. When other standards are required the assay processes are printed in the individual monographs. In contrast with this the U. S. P. gives in its general notices, directions for preservation, limits on foreign organic and inorganic matter and in its appendix methods for the assay of drugs including sampling, foreign organic matter, total ash, acid-insoluble ash, moisture, crude fiber, volatile and non-volatile ether extract, other solvent extracts, alkaloidal assays, etc., besides the assay processes given in the individual monographs.

Contrasted with the accurate and complete assay methods of the U. S. P. those of the G. P. have apparently been designed for simplicity and economy of apparatus and it is the opinion of the writer that in the effort to obtain this simplicity, accuracy has oft-times been sacrificed. For example, compare the well known volatile ether extractive method with the G. P. method for the determination of percentage of volatile oil in drugs. This latter consists briefly of distilling the ground drug with water, the distillate being salted out

and shaken with pentane, the collected pentane washings being evaporated at low heat and the residue weighed.

One feature worth mentioning, however, in connection with alkaloidal assay is that in many cases the G. P. directs that the solution remaining after the titration is completed be used for qualitative tests for the alkaloids, methods for these tests being given in the monograph. This is presumably a sort of identity test for the drug.

Bio-assay methods are absent from the G. P. Ergot and Strophanthus are assayed chemically and Digitalis is standardized in government laboratories and sold certified to the pharmacist.

## Summary

Both books exhibit quite a bit of similarity in scope, the evident differences being due to geographical distribution and local medical opinion. Monographs of drugs occurring in both books show a similarity of sequence but are more complete and accurate in the U. S. P. except for the indication of—and microscopic method for the detection of, adulterants, and identity and purity tests, which are more numerous in the G. P. The G. P. monograph employs probably fewer technical terms and due to its composition of complete sentences is somewhat easier to read. Its method of giving size of starch grains seems better than that of the U. S. P. Assay methods are designed for simplicity and are doubtless inferior to those of the U. S. P. at least according to American analytical ideas. The criticism that the G. P. as a whole is a better working manual for the pharmacist while the U. S. P. is better for the control chemist, seems also applicable to the vegetable drugs. But then, should not the pharmacist be educated to comprehend his pharmacopœia? And after all, is not the setting of the standards the primary function of a pharmacopœia?

TABLE I

Vegetable Drugs Official in the German Pharmacopœia, but not in the United State Pharmacopœia. Those marked * are also in the N. F. 5. (Official G. P. titles are given.)

| | | |
|---|---|---|
| Ammoniacum | Folia Farfarae* | Lignum Guajaci* |
| Amygdalae dulces | Folia Juglandis | Lignum Sassafras* |
| Carrageen* | Folia Malvae* | Mastix* |

Catechu
Cautschuc
Cortex Condurango*
Cortex Frangula*
Cortex Quercus*
Cortex Quillaiae*
Crocus*
Dammar
Dextrinum*
Euphorbium
Faex Medicinalis*
Flores Arnicae*
Flores Chamomillae*
Flores Cinae
Flores Koso
Flores Lavandulae
Flores Malvae
Flores Sambuci*
Flores Vervasci*
Flores Tiliae
Folia Althaeae*
Folia Melissae
Folia Salvia
Folia Trifolii fibrini
Fructus Anisi*
Fructus Aurantii immaturi
Fructus Foeniculi*
Fructus Juniperi*
Fructus Lauri
Fructus Piperis nigri*
Galbanum
Guttapercha
Herba Absinthii
Herba Cardui benedicti
Herba Centaurii*
Herba Serpylli
Herba Thymi*
Herba Violae tricoloris
Kamala
Lichen islandicus
Herba Meliloti*
Opium Concentratum
Pericarpum Citri
Placenta Sem. Lini
Pulpa Tamarindorum*
Pulpa Depurata
Radix Angelicae*
Radix Levistici
Radix Ononidis
Radix Pimpinellae
Radix Saponariae
Rhizoma Calami
Rhizoma Galangae*
Rhizoma Iridis*
Rhizoma Tormentillae
Rhizoma Zedoaria*
Semen Arecae
Semen Papaveris
Semen Sabadillae
Terebinthina*
Tubera Salep

## TABLE II

Vegetable Drugs Official in the United States Pharmacopœia, but not in the German Pharmacopœia.

Aconitum
Aurantii Dulcis Cortex
Belladonnae Radix
Buchu
Cannabis
Cascara Sagrada
Cimicifuga
Colchici Cormus
Eriodictyon
Eucalyptus
Gambir
Ipomoea
Kino
Limonis Cortex
Maltum
Mentha Viridis
Myristica
Pepo
Podophyllum
Prunus Virginiana
Rhus Glabra
Rosa
Serpentaria
Ulmus
Opium Granulatum

## TABLE III

Vegetable Drugs Occurring in both the German and United States Pharmacopœias.
(U. S. P. Official Latin titles or abbreviations given.)
(See also Page 1 of this Report.)

### ABBREVIATIONS USED IN THIS TABLE

NMT—not more than.
NLT—not less than.
FOM—foreign organic matter.
AI—acid insoluble.
St.—starch.
Alk.—alkaloids.
Tf—tests for.
Den.—density.
Sol.—solubility (soluble).
S.T.—solubility tests.
VEEx.—volatile ether ext.
NVEEx.—non-volatile ether extract.

| *Drug.* | *Standard.* | | *Indentity tests.* | | *Purity indications and tests.* | |
|---|---|---|---|---|---|---|
| | *U.S.P.* | *G.P.* | *U.S.P.* | *G.P.* | *U.S.P.* | *G.P.* |
| Acacia. | none. | none. | basic lead acet. | basic lead acet. alcohol $FeCl_3$. | NMT 1% water insol. res. NMT 15% moist. Tf tsnnin, gum, starch. | NMT 4% ash. Tf starch, dextrin, sugar. |
| Agar. | none. | none. | Iodine test. | Iodine test. | NMT 1% FOM. NMT 1% AIash. NMT 16% moist. Tf gelatin, St. | none. |
| Aloe. | NLT 50% $H_2O$ sol. extract. (Note: Cape only off. in G. P.) | none. | $HNO_3$ color. borax. $NH_4OH$. | S.T. 's. Borax. color $CHCl_3$ ether. | NMT 10% moist. NMT 4% ash. Tf gum. inorg. impurities. | NMT 1.5% ash. Tf other aloe, poor aloe, resins. |
| Althea. | none. | none. | NaOH. | $NH_4OH$. | none. | NMT 7% ash. Tf cork, limed drug, color. |
| Amylum. | none. (Note: corn off. in U. S. P. rice & wheat off. in sep. monographs in G. P.) | none. | boiling. | none. | N.M.T. trace FOM. NMT 0.5% ash. st. NMT 14% moist. litmus test. Tf iron. | NMT 1% ash. NMT 15% moist. Tf bran, other starches. litmus test. |
| Asa-fœtida. | NLT 50% alc'ic extract. | NLT 50% alc'c extract. | alkali $H_2SO_4$ fluor. phlor. | alkali fluor. | NMT 15% AIash. Tf galbanum, for. resins, rosin, ammoniac. | NMT 15% ash. Tf galbanum. |
| Aspidium. | NLT 6.5 % oleo-resin. green color. | NLT 8% ext. of which 25% is filicin green. | none. | none. | NMT 3% AIash. | NMT 4% ash. |
| Aurant. Amari Cort. | none. | none. | NaOH. | KOH. | none. | Tf Curacao, green varieties. |

| Drug. | *Standard.* U.S.P. | G.P. | *Indentity tests.* U.S.P. | G.P. | *Purity indications and tests.* U.S.P. | G.P. |
|---|---|---|---|---|---|---|
| Bals. Peruv. | NLT 50% NMT 60% cinnamein. | NLT 56% cinnamein. | Den. Sol. $FeCl_3$ | Den. Sol. $FeCl_3$ | Acid No. Sap. No. Tf rosin fixed oil, turpentine. | Ester No. Tf rosin, fix. oil, turp. benzald. gurjun bals. artif. bals. |
| Bellad. Folia. | NLT 3% alkaloids. | NLT 3% hyoscyamine. | none. | none. | NMT 3% stems over 10 mm. NMT 3% AIash. Tf stramonium phytolacca. | stems, flrs., fruits must be absent. NMT 15% ash. Tf Ailanthus, phytolacca, plantago. |
| Benzoin. | NLT 75% & 90% alc'ic extract. | NMT 2% residue after extr'n. | alc. $H_2O$ litmus. sublim. $H_2SO_4$. $KMnO_4$. 12.5% benzoic acid. | alc. $H_2O$ litmus. $CS_2$ test for benzoic acid. | Sumatra. NMT 1% AIash. Siam. NMT 0.5% AIash. (Note: Siam only official in German. Pharm.) | NMT 1% ash. $KMnO_4$ test for Sumatra. |
| Calumba. | none. | none. | none. | micro-sublim. $H_2SO_4$ | NMT 2.5% AIash. | NMT 9% ash. |
| Cambogia. | NLT 65% alc. sol. extract. | none. | emuls. $NH_4OH$ | emuls. $NH_4OH$ HCl | NMT 1% AIash. NMT 1% FOM Tf starch | NMT 1% ash. Tf starch. |
| Capsicum. | NLT 12% NVEEx (Note: African off. in U. S. P. Spanish off. in G. P.) | none. | none. | none. | NMT 1.25% AIash. Tf Jap. Scovill test. | NMT 8% ash. Tf corn st., curcuma, coal tar color. |
| Carbo Ligni. | none. | none. | none. | none. | burns with non-luminous flame. | burns with non. lu. flame. |
| Cardamomi Semen. | none. | none. (Note: Entire fruits off. in Germ. Pharm.) | none. | none. | NMT 5% AIash. | NMT 10% ash. Tf cereals, ginger, pericarp in powd. |
| Carum. | none. | NLT 4% vol. oil. | none. | none. | NMT 1.5% AIash. NMT 3% other fruits, seeds or FOM. | NMT 8% ash. Tf parts of umbel and stem in powd. |
| Caryophyllus. | NLT 15% VEEx. | NLT 6% vol. oil. | none. | $FeCl_3$ | NMT 5% stems. NMT 1% FOM. NMT 10% cr. fib. NMT .75% AIash. Tf stems, fruits, cereals. | NMT 8% ash. Tf stems, fruits. |

| *Drug.* | *Standard.* U.S.P. | *Standard.* G.P. | *Indentity tests.* U.S.P. | *Indentity tests.* G.P. | *Purity indications and tests.* U.S.P. | *Purity indications and tests.* G.P. |
|---|---|---|---|---|---|---|
| Chrysarobinum. | none. | none. | $H_2SO_4$ alkalis $HNO_3$ $NH_4OH$ | $H_2SO_4$ alkalis $HNO_3$ $NH_4OH$ | NMT .25% ash Solution neutral to litmus. | NMT .3% ash. |
| Cinchona. | NLT 5% alk. | NLT 6.5% alk. | none. | Grahe's (Note: red only off. in G. P.) | none. | NMT 5% ash. Tf other Cinchonas. Ladenbergia sp. |
| Cinnamomum. | NLT 2% VEEx | NLT 1% vol. oil. | none. | none. (Note: Saigon off. in U. S. P.) (Note: Ceylon off. in G. P.) | none. | NMT 5% ash. Tf wood, chinese cassia. |
| Colch. Semen. | NLT .45% colch. | NLT .4% | none. | none. | none. | NMT 4.5% ash. |
| Colocynth. | none. | none. | none. | none. | NMT 6% AIash NMT 2% epicarp NMT 5% seeds NMT 2% benz. extract. | Seeds to be removed before using. Tf seed, epicarp in pow. Tf starch. |
| Copaiba. | none. | none. | sol. test in petrol. ether. | sol. test in petrol. ether. | Den. Tf. paraffin, fatty oils, gurjun balsam African Copai. | Den. Tf paraffin, fatty oils, gurjun bals. turpentine. |
| Cubeba. | NMT 10% VEEx | none. | $H_2SO_4$ | $H_2SO_4$ | NMT 5% shriv. fruits or stem. NMT 2 other FOM. | NMT 8% ash. Tf Piper sp. stems. |
| Digitalis. | bio. assay. | gov't. stand. | none. | none. | NMT 2% stems, flowers or FOM. NMT 5% AIash. | NMT 3% moist. NMT 13% ash. Tf hyoscy., datura. atropa. |
| Ergota. | bio. assay. | NLT .05% alk. | sclererythrin test. | none. | NMT 5% seeds, fruits. FOM. Hot water test. | Hot water test. |
| Galla. | none. | none. | none. | $FeCl_3$ | none. | none. |
| Gentian. | NLT 30% $H_2O$ sol. extract. | NLT 33% dil-alc. extract. | none. | none. | none. | NMT 5% ash. Tf cocoanut shell, Rumex, micro-subl. |
| Glycyrrhiza. | none. | none. | none. | $H_2SO_4$ | NMT 2.5% AIash. | NMT 6.5% ash. No cork cells. |
| Gossyp. Purif. | none. | none. | none. | sinking in $H_2O$ test. | NMT .2% ash. Tf acid, alkali, fat, dyes, $H_2O$ sol. subst. | NMT .3% ash. Tf HCl, $H_2SO_4$ Ca salts, reducing subst. |
| Granatum. | none. | NLT .4% alk. | $FeCl_3$ $Ca(OH)_2$ | $FeCl_3$ | NMT 2% wood or other FOM. | NMT 17% ash. Tf other barks. |

| *Drug.* | *Standard.* U.S.P. | *Standard.* G.P. | *Indentity tests.* U.S.P. | *Indentity tests.* G.P. | *Purity indications and tests.* U.S.P. | *Purity indications and tests.* G.P. |
|---|---|---|---|---|---|---|
| Hydrastis. | NLT 2.5% ether sol. alk. | NLT 2.5% hydrastine. | $H_2SO_4$ | $H_2SO_4$ | NMT 3% AIash. NMT 2% stems & leaves. NMT 2% other FOM. | NMT 6% ash. No other plant parts. No St. over 20 u. Tf curcuma. |
| Hyoscyamus. | NLT .065% alk. | NLT .07% Hyoscyamin. | none. | none. | NMT 12% AIash. NMT 25% stems over 7 mm. | NMT 30% ash. Tf stems, flrs. lvs. in powd. |
| Ipecacuanha. | NLT 1.75% ether sol. alk. | NLT 1.99% alk. | none. | none. | NMT 5% over ground stems. NMT 2% other FOM. | Test in powd. for rhizome & other roots. NMT 5% ash. |
| Jalap. | NLT 7% resin. | NLT 10% resin. | none. | none. | none. | NMT 6.5% ash. Tf woods, Ipom. |
| Krameria. | none. | none. | none. | none. | none. | NMT 5% ash. Tf weak spec. |
| | Note: Peruvian only off. in G. P.) | | | | | |
| Linum. | NLT 30% NVEEx 98% sapon. | none. | none. | none. | NMT 2% other seeds or other FOM. NMT 5% AIash. Tf starch bearing seeds. | Tf starch, other seeds. NMT 5% ash. |
| Lobelia. | none. | none. | none. | none. | NMT 10% stems. NMT 2% other FOM. NMT 5% AIash. | NMT 12% ash. |
| Lycopodium. | none. | none. | $H_2O$ flame. | $H_2O$ flame. | Tf pine pollen starch, dextrin. | NMT 3% ash. Tf sulphur, pine & cory. Ius pollen. Typha, talc, rosin & others. |
| Manna. | NLT 75% anh. alc. extract. | NLT 75% mannite. | none. | none. | NMT 40% yellow fragments. | NMT 3% ash. NMT 10% moist. |
| Mentha Pip. | none. | NLT .7% vol. oil. | none. | none. | NMT 2% stems over 3 mm. or other FOM. | Stems must be absent. NMT 12% ash. |
| Myrrha. | NLT 30% alc. ext. | NMT 66-2/3% residue after extn. | none. | Emuls. $HNO_3$ $H_2SO_4$ vanillin test. | NMT 4% AIash. | NMT 7% ash. |
| Nux Vomica. | NLT 2.5% alk. | NLT 2.5% alk. | none. | none. | none. | NMT 3% ash. must contain no starch. |
| Opium. | NLT 9.5% anhyd. morph. | Dried at 60. NLT 12% morph. | none. | none. | none. | none. |

| *Drug.* | *Standard.* U.S.P. | *Standard.* G.P. | *Indentity tests.* U.S.P. | *Indentity tests.* G.P. | *Purity indications and tests.* U.S.P. | *Purity indications and tests.* G.P. |
|---|---|---|---|---|---|---|
| Opium pulv. | NLT 10% NMT 10.5% morph. | about 10% morph. | none. | none. | none. | NMT 8% moist. |
| Pix Pini. | none. | none. | litmus $FeCl_3$. | litmus $FeCl_3$ lime water. | NMT .25% ash. | none. |
| Quassia. | none. | none. | none. | none. | none. | Tf other woods. |
| Resina. | none. | none. | acid. no Sol. fusing. | acid. no Sol. litmus. | NMT 0.05% ash. | none. |
| Rheum. | NLT 30% dil. alc. extract. | none. | emodin chrys. ac. test. | micro-sublim. | Tf rhapontic rhubarb. | NMT 28% ash. NMT .5% AIash. Tf licorice, almonds, flour, curcuma, rhap. rhubarb, inferior grades. |
| Sarsaparilla. | none. (Note: Honduras only off. in Germ. Phar.) | none. | none. | none. | NMT 2% FOM. no crown or rhiz. in powd. Mex. NMT 4% AIash. NMT 2% in others. | NMT 8% ash. Tf other var. Angola Sars. Hemidesmus, Philodendron, Must cont. no stone cells, cork dyes. |
| Scilla. | bio. assay. | none. | none. | none. | none. | NMT 5% ash. no starch or thick walled cells. |
| Senega. | none. | none. | none. | watery mixt. foams. | NMT 5% stems or other FOM. | NMT 5% ash. Tf other roots. |
| Senna. | none. | none. | ether $NH_3$ test. | benzene $NH_3$ test. | NMT 10% stems. NMT 2% pods or other FOM. | NMT 12% ash. Tf Colutea, Solenostemma, Coronilla, Coriaria, Ailanthus, Theophrosia sp., Cassia auriculata. |
| Sinap. Nigra. | NLT .6% vol. oil. | NLT .7% vol. oil. | none. | none. | NMT 5% other seeds or FOM. | NMT 5% ash. Tf wheat st. curcuma. |

| *Drug.* | *Standard.* U.S.P. | *Standard.* G.P. | *Indentity tests.* U.S.P. | *Indentity tests.* G.P. | *Purity indications and tests.* U.S.P. | *Purity indications and tests.* G.P. |
|---|---|---|---|---|---|---|
| Stramonium. | NLT .25% alk. | none. | none. | none. | NMT 3% stems over 8 mm. NMT 4% AIash. | NMT 20% ash. Tf stem parts. Solanum, Lactuca, Xanthium species. |
| Strophanthus. | bio. assay. | NLT 4% strophanthin. | none. | $H_2SO_4$ | none. | NMT 7% ash. Tf other varieties. |
| Toll. | none. | none. | acid no sap. no litmus. | acid no sap. no litmus $KMnO_4$ $FeCl_3$ | Tf rosin, copaiba. | Tf rosin. NMT 1% ash. |
| Tragacanth. | none. | none. | mucilage. | none. | Tf foreign gum india gum. | NMT 3.5% ash. Tf acacia, st., dextrin. |
| Uva Ursi. | none. | none. | $FeSO_4$ Microsubl. | $FeSO_4$ | NMT 5% stems or other FOM. | NMT 4% ash. No stems. Tf other Ericaceae, Buxux. |
| Valerian. | none. | none. | none. | none. | NMT 5% FOM. NMT 10% AIash. | NMT 15% ash. Tf foreign roots, above grd. stems, Vineetoxium. |
| Veratrum Viride. | none. | none. | none. | none. | NMT 5% stems or other FOM. NMT 4% AIash. | NMT 12% ash. |
| | (Note: V. album off. in G. P.) | | | | | |
| Zingiber. | NLT 2% NVEEx. NLT 12% cold water extract. | NLT 1.5% vol. oil. | none. | $H_2SO_4$ | none. | NMT 7% ash. Tf linseed meal, rice, corn, cereals, curcuma. |

Note: The U. S. P. "General Notice," standard on acid-insoluble ash has not been included in this table. Where no ash standard is given under the U. S. P "Purity" column NMT 2% acid-insoluble as is implied.

## SOME MEDICAL ASPECTS OF PHARMACOGNOSY*

**By Seward E. Owen**

WE, AS PHARMACISTS, are interested in pharmacognosy as pertaining to crude drugs because of the substances in these drugs which give them their medicinal value or physiological action. We impress the students with the necessity of learning the constituents of the important drugs. During this learning period we may mention the action of the constituents, but this is thought to belong more properly to the subject of materia medica, and perhaps rightly so for the latter mentioned is a very strenuous and important subject. Few, if any schools of pharmacy, however, give actual demonstrations of important drug constituents.

All drug substances do not easily lend themselves to actual demonstration as to action. There are, however, groups of important drugs and even single medicinal substances which are becoming so widely used that it appears wise to make the coming pharmacist a person of experiences instead of a mere memorizer of important physiological effects. It is quite well accepted that one generally remembers what one sees better and for a longer time than what one merely hears or reads about.

Biological standardization is becoming more important in pharmaceuticals because of the recent introduction of glandular extracts, hormones, plant proteins for desensitization and the older well-accepted tests as the one hour frog and the coxcomb test, even few of these standard tests are shown to students for time seems precious and all that is left to memory.

If the embryo pharmacist had witnessed the effects of *strychnine* (the action of which is said to affect the lower spinal cord) he would recognize strychnine spasms and what is more, be impressed with the importance of keeping a legible poison register. The paralysing of the eye pupil muscles (pupil constrictors) by the use of *atropine* is common to the optometrist and should be a matter of experimental observation in every druggist's life. Other drugs as *caffeine* (which renders the central nervous system excitable) lowering the filtration pressure of the glomerulis of the kidney thus causing diuresis and rendering the animal hyperexcitable. *Nicotine* whose powerful action

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in paralysing synapic nerve ganglions and the use of which has come into prominence in the tracing of nerve pathways because of this action. *Adrenalin* (almost a household word in those homes containing plethoric individuals), whose double action spells danger in hemorrhages, the eye dilation, and effect on blood pressure, etc. The new much-touted substitute *ephedrine* and its action.

*Morphine* (used by the "dope addicts" to produce brilliancy of thought, etc.), this narcotic is easily demonstrated on laboratory animals, the soporific action is sudden and complete. *Digitalis* with its heart tonic and stimulant action is very important. Many of these and more, well merit actual demonstration of action on laboratory animals.

*Antagonistic action,* namely, the action of *pilocarpine* against the paralysant action of *atropine* on the heart (pseudo nerve block). Other well-known cases could be given but it is the idea and not the layout of work that I wish to give here.

On a trip through one of the largest manufacturers of medicinal products about the first laboratory the visitor is to be taken to is the animal experimentation room, where many drugs are being tested for irritability, protein effect, action on blood pressure and heart rate on the injection, etc. Why? Because it is commercially important to know physiological actions and faults of medicinal substances.

About the only argument against such a plan is that it would take time from laboratory work; with good snappy technique and assistants most important demonstrations should not take over two hours. I have seen demonstrations over much longer periods of time and I have overheard the discussions of students later, and from this I think it pays. Surely such demonstrations tend to keep the interest up throughout the year. And it makes the pharmacist to a more certain extent a person of experiences and not solely a memory automaton, if she or he has witnessed some ten or a dozen or more demonstrations as I have merely touched on in this paper.

With the introduction of another year to the curriculum of pharmacy teaching, we are bound to make pharmacy a more broadening course of study. If pharmacy is the handmaid of medicine we should give the handmaid some ground in common with the doctor. The intense crowding of the drug field with new medicaments introduces more therapeutics to be mastered, the busy doctor can hardly be expected to keep up with them all. The druggist is

reputed to be more than a merchant because of his specialized training, yet some pharmacists are but very little more than merchants at present. The druggist who knows his therapeutics and actions of drugs can forge ahead in the prescription business because he is on a level in at least one branch with his doctors and can talk intelligently of his wares, thus he is certainly eligible for more prescription work.

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## ON ABBREVIATIONS IN PHARMACOPŒIA (U. S. P. X) AND NATIONAL FORMULARY* (N. F. V)

**By Charles C. Plitt**

IN THIS PAPER I am presenting some of the inconsistencies in abbreviating the Latin official names noted in the Pharmacopœia and the National Formulary. If I understand the reason for the abbreviations, it is to sanction the ones given as official, and therefore the only ones that should be used. Now, if this is true, there should be uniformity in abbreviating the same word, for example, Cinchona, should not be abbreviated once Cinchon. and at another time, Cinch.; and there should be uniformity in abbreviating even different words, for example Amidopyrina is abbreviated Amidopyrin., whereas Antipyrina is abbreviated Antipyr. As a rule, a name should seldom be abbreviated to such an extent that the identity of the name is lost. In the lists that follow I am giving the inconsistencies that I have run across, with comments.

Acidum Sulphuricum is abbreviated Acid. Sulphuric.; in Acidum Sulphuricum Aromaticum and also in Acidum Sulphuricum Dilutum, Sulphuricum is abbreviated Sulph. For the sake of uniformity, the word should be abbreviated each time either Sulph. or better Sulphuric.

Amidopyrina is abbreviated Amidopyrin.; on the other hand Antipyrina is abbreviated Antipyr. Amidopyrin. is good, and Antipyrina, should be abbreviated Antipyrin.

Anisum is abbreviated Anis. Aqua Anisi could well be abbreviated Aq. Anis.

Bitumen Sulphonatum is abbreviated Bitum. Sulph. Now Sulph. is the abbreviation for Sulphur. It seems to me the better

*Plant Science Seminar.

abbreviation would be Sulphon. In fact it is abbreviated that way in Collodium Bituminis Sulphonati.

Caffeinæ Sodio-Salicylas is abbreviated Caff. Sod.-Sal. Now Salicylas is abbreviated Salicyl. and the abbreviation should be Caff. Sod.-Salicyl.

Calcii Phosphas Præcipitatus has Præcipitatus abbreviated Præ.; it should be Præc. to conform with the way the word is abbreviated elsewhere.

Cascara Amargo is abbreviated Cascar. Amarg. On the other hand Cascara Sagrada is abbreviated Casc. Sagr. It seems to me it should be Casc. Amarg.

Ceratum Resinæ Compositum has Resinæ abbreviated Resin.; in Ceratum Resinæ, the same word is abbreviated Res. For the sake of uniformity, it should be either the one or the other, preferably Resin.

Elixir Aletridis Compositum is abbreviated Elix. Aletrid. Co. Since Aletris is abbreviated Aletr. it should be abbreviated Elix. Aletr. Co. This applies also to the Fluidextractum.

Elixir Bromidorum Quinque is abbreviated Elix. Bromid. Quinq. In Elixir Bromidorum Trium, Bromidorum is abbreviated Brom. It should be abbreviated Elix. Bromid. Tri.

Elixir Cardamomi Compositum, is abbreviated Elix. Card. Co.; in Cardamomi Semen, we have Cardamomi abbreviated Cardam., it should be Elix. Cardam. Co.

Elixir Cinchonæ Alkaloidorum has Cinchonæ abbreviated Cinchon., Cinchona, however, is abbreviated Cinch. For the sake of uniformity Cinchona should be abbreviated either Cinch. or Cinchon., preferably the latter as it is abbreviated that way in the Fluidextractum.

In Elixir Corydalis Compositum, Corydalis is abbreviated Coryd.; Corydalis, itself, is abbreviated Corydal., likewise in the Fluidextractum, it is abbreviated Corydal. It should be abbreviated Corydal. also in the Elixir.

Gentiana, is abbreviated Gent. in Elixir Gentianæ, elsewhere, in Gentiana, in the Extractum and the Fluidextractum it is abbreviated Gentian. It should be abbreviated also this way in the Elixir Gentianæ.

We note the same with Guarana; in the Elixir, it is abbreviated Guar., elsewhere Guaran. It should be abbreviated the same way

also in Elixir Guaranæ, and Guarana itself, might be also thus abbreviated.

Elixir Heloniadis Compositum is abbreviated Elix. Heloniad. Co., why not Elix. Helon. Co., since Helonias is abbreviated Helon. and the genitive, itself is thus abbreviated in Fluidextractum Heloniadis.

Extractum Euonymi, has Euonymi written out in full, it can be abbreviated to Euonym. since Euonymus is thus abbreviated.

Since Adonis is abbreviated Adon. the Fluidextractum should be abbreviated Fldext. Adon. and not Fldext. Adonid.

Although Juglans is not abbreviated, I see no reason why it should not be abbreviated Juglan. and the Fluidextractum to Fldext. Juglan. and not Fldext. Jugland.

Fluidextractum Senecionis is abbreviated Fldext. Senecion. Why the n?

Fluidextractum Serpentariæ, is abbreviated Fldext. Serpentar. Since Serpentaria, is abbreviated Serpent., the Fluidextractum should be abbreviated Fldext. Serpent.

Formaldehydum Cresolatum is abbreviated Formal. Cresol. On the other hand Formaldehydum, in Liquor Formaldehydum is abbreviated Formaldehyd. In the first case, it should also be abbreviated the same way, thus Formaldehyd. Cresol.

Hydrochloridi in Liquor Epinephrinæ Hydrocloridi, is abbreviated Hydrochlor., elsewhere it is abbreviated Hydrochl. It should be abbreviated the same way here also.

Calamina is abbreviated Calamin. in Calamini Præparata, it should be abbreviated the same way in the preparations and not Linimentum Calam. and Lotio Calam., etc.

Linimentum Saponato-Camphoratum is abbreviated Lin. Sapon. Camph., why not Lin. Sapon.-Camph.?

Linimentum Saponis Mollis is abbreviated Lin. Sapon. Moll., whereas Linimentum Saponis Mollis Compositum, is abbreviated Lin. Sapon. Mol. Co.

Aromaticus is abbreviated Aromat. in Liquor Aromaticus Alkalinus, but Arom. in Elixir Aromaticum Rubrum. Aromat., it seems to me, is to be preferred.

Albuminati is abbreviated Albumin. in Liquor Ferri Albuminati and Album. in Ferrum Albuminatum. Here, too, it should be abbreviated Albumin.

Liquor Iiodi et Zinci Phenolsulphonatis is abbreviated Liq. Iodi et Zinc. Phenolsul. Why not Iod. for Iodi, and Phenolsulpon. for Phenolsulphonatis?

Regarding Iodi, Iodumis abbreviated Iod.; yet in Tinctura Iodi, we have Tr. Iodi, in Tinctura Iodi Fortior, we have Tr. Iod. Fort., and in Liquor Iodi Phenolatus, we have Liq. Iodi Phenol. Iodi should be abbreviated Iod. every time.

Hydrochloridi in Liquor Procainæ Hydrochloridi should be abbreviated Hydrochl. and not Hydroch. Likewise in Morphinæ Hydrochloridum it should be abbreviated Hydrochl. and not Hydrochlor.

Acidum is always abbreviated Acid., yet in Mulla Acidi Salicylici, Acidi is abbreviated Ac. It should be abbreviated Acid.

Magnesii and Magnesiæ are abbreviated Mag. yet in Magnesii Chloridum, it is abbreviated Magnes. It should be Mag. and conform with abbreviations elsewhere.

Nitrogenii Monoxidum is abbreviated Nitrogen. Monox., why not Monoxid. since Oxidum is abbreviated Oxid.?

Oleum Anisi is abbreviated Ol. Anisi, it could well be Ol. Anis.

Oleum Terebinthinæ is abbreviated Ol. Tereb. Terebinthinæ is abbreviated the same way in Oleum Terebinthinæ Rectificatum, however, Terebinthina is abbreviated Terebinth., it too, could well be abbreviated Tereb.

Hyoscyami in Oleum Hyoscyami Compositum is abbreviated Hyoscy. Hyoscyamus, however, is abbreviated Hyosc.

Nitras in Potassii Nitras, is not abbreviated yet in Pilocarpinæ Nitras, it is abbreviated Nit.

Likewise Chloridum in Potassii Chloridum is abbreviated Chlorid. but in Ammonii Chloridum it is abbreviated Chlor. which is sufficient.

Betanaphthol is abbreviated Betanaph. yet in Pasta Betanaphtholis, we have it abbreviated Betanapth.; it should be Betanaph.

Dextrinum Album is abbreviated Dextr. Alb. and Pasta Dextrinata is abbreviated Past. Dextrin. It seems to me that Dextrinum Album should be abbreviated Dextrin. Alb.

Sulphurata in Pasta Zinci Sulphurata is abbreviated Sulphur.; in Potassa Sulphurata, it is Sulphurat. It should be Sulphurat. in all cases.

Canellæ in Pulvis Aloes et Canellæ is abbreviated Canell., yet Canella, itself, is abbreviated Canel. It should be Canel. in both cases.

Tannas in Quininæ Tannas is abbreviated Tan. in Pelletierinæ Tannas, it is Tann. Here it should be one or the other.

Hydrobromidum is abbreviated Hydrobrom. in Scopalaminæ Hydrobromidum, and Hydrobr. in Quininæ Hydrobromidum. It should be Hydrobr. in both cases.

Aethylic is abbreviated Aeth. in Spiritus Aethylic Nitritis, and Aethyl. in Aethylic Chloridum. It should be Aethyl. in both cases.

Mastiches is abbreviated Mastic. in Solutio Mastiches Chloroformica Composita, and Mastich. in Pilulæ Aloes et Mastiches. Here it should be one or the other, preferably Mastich.

Myrciæ is abbreviated Myrc. in Oleum Myrciæ but is not abbreviated at all in Spiritus Myrciæ Compositus. There is no reason why it should be abbreviated here, too.

Vanillini is abbreviated Vanil. in Spiritus Vanillini Compositus, but in Elixir Vanillini Compositum it is abbreviated Vanillin. It seems to me that the latter abbreviation is the correct one.

Syrupus Calcii Iodidi, has Iodidi abbreviated Iodid., the same word is abbreviated Iod. in Potassii Iodidi. Iodid., I should say is the correct abbreviation.

Glycyrrhizæ in Syrupus Glycyrrhizæ is abbreviated Glycyrrhiz., Glycyrrhiza, itself is abbreviated Glycyrrh., and the same abbreviation should stand for the genitive.

Rubi is sometimes abbreviated and sometimes not, and so, too, is Aloes.

Quas. is the abbreviation of Quassiæ in Tinctura Quassiæ, it should be Quass. to conform with the abbreviation given for Quassia.

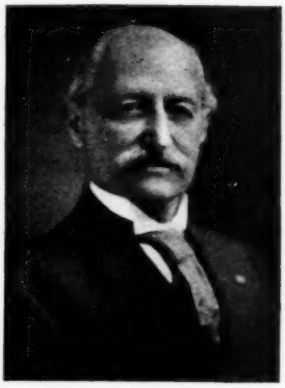
Tinctura Persionis is abbreviated Tr. Persion., why not Tr. Persio.?

There are probably other such inconsistencies and should be corrected. It seems to me that if the abbreviations given stand for anything, this is highly imperative.

# IN MEMORIAM

## JOSEPH LYON LEMBERGER, Ph. G., Ph. M.

THE OLDEST living graduate of Philadelphia College of Pharmacy and Science, ex-President of the American Pharmaceutical Association, Treasurer of the Pennsylvania Pharmaceutical Association from the time it was organized until 1911, when he became President; Vice-President of the Philadelphia College of Pharmacy and Science, and a member of its Board of Trustees for many years and a life-long leader in civic affairs in the City of Lebanon, Pennsylvania, passed quietly into the unknown Beyond on Thursday, September 28, 1927, at his late residence, Sixth and Cumberland Streets, Lebanon.



J. L. Lemberger

Mr. Lemberger for over fifty years conducted one of the leading retail pharmacies in Lebanon County first as an individual owner and afterward as a partner with Francis E. Gleim, Ph. G.

For several years he was the Secretary as well as a member of the Board of Trustees of the Pennsylvania Hospital for Incurable Insane at Wernersville, Pa.

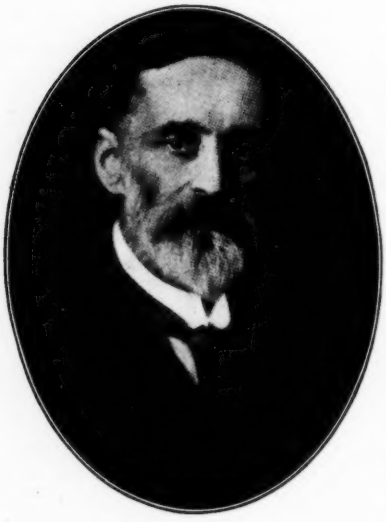
Our oldest alumnus graduated in 1854, and his interest in the affairs of Philadelphia College of Pharmacy and Science was continuous during his whole career. His studious interest in botanical science prompted publication of several papers in this Journal in the last quarter of the nineteenth century, and his ability as a professional pharmacist brought him into congenial contacts with the recognized leaders of his profession in this country, many of whom were his close personal friends.

A lifetime covering ninety-three years is longer than the usual journey, and devoted to unselfish usefulness as exemplified in the career of Joseph Lyon Lemberger makes a record that merits the praise and lasting esteem of those who remain.

W. L. C.

## SIR WILLIAM SAMUEL GLYN JONES

AT THE COMPARATIVELY early age of fifty-eight years, yet closing a life of unparalleled activity, this internationally famous pharmacist passed away in Vancouver, Canada on September 9, 1927.



**Sir William Glyn-Jones**

International were the scope and results of his work—international the esteem and respect in which he was held—and now—that he is gone—internationally is he mourned.

From an obscure corner in London town the movement of price standardization, modestly initiated by the then young Welsh chemist, attained to such momentum that not even the oceans could stop its progress.

It has spread to all corners of earth. It was undoubtedly the strenuous task of carrying his plan to effect in Canada, that hastened the end of this marvelous organizer and exponent of pharmacy.

That a prophet is without honor at home is a commonly quoted aphorism—but to this man—in life and in death—came equal appreciation—home as well as abroad.

Of him a fellow-worker, F. Pilkington Sargeant, Ph. C., Past-President of the Pharmaceutical Society of Great Britain, writes:

> "The passing of Sir William Glyn-Jones awakens the fear and must arose the affection of his colleagues. His was a turbulent spirit which influenced all the activities of a boisterous life, but underlying this was an almost childish simplicity by which he endeared himself to those who really knew him. Politician, pharmacist, and raconteur, he swayed the minds of men, and directed their actions, but deeper than all his public works lay the soul of a man, indescribably sweet, and fascinating to a degree. He met his end as he worked his life, optimistic to the last, lovable and of such nobility of character that one can only hope that there

may arise someone who can continue his service in accordance with his noble and inspiring achievement and example. Pharmacy has lost an advocate and a friend, and I mourn, with all my colleagues, the loss of a personality who I am afraid cannot be replaced."

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## ELIZABETH BAILY REMINGTON

### A Son's Tribute†

A LIFE, LOVINGLY and unselfishly lived, has in it more power for good than the preaching of many sermons or the passing of numerous laws. When one looks back over the experiences of a lifetime, do we not all feel that it is persons, not events or things, or books, or even circumstances which have most influenced our characters in the making. Happy indeed is the individual that has been brought constantly into touch with personalities, who by tender care and loving influence have moulded and guided his life. A truly good mother is beyond the praise of men, and no one of us can ever fittingly pay tribute to her, who nurtured us before we were born, and who guided our first footsteps upon the path of life.

My mother, Elizabeth Baily Remington, was born in old Philadelphia in the year 1840. She was of Quaker stock on both sides of the family, John Collins of Burlington, New Jersey, being her father, and Anna Baily her mother. She was educated at West Town Boarding School and the Mary Anna Longstreet School in Philadelphia, both private institutions under the guidance of the Society of Friends. Later on and in fact up until the time of her marriage to Professor Joseph Price Remington she was a teacher in Miss Mary Anna's School for girls.

She was thirty-five years old when she was married, but the years rested as ever, so lightly on her shoulders, that she turned all of that abundant vitality into the rearing of a family of five vigorous children, three sons and two daughters. They must have been a handful at times, for the first four children were born between the year 1876 and 1881, and were, both active and boisterous. Mother taught them all the rudiments of their early education and sent them on to school later, well equipped in the three R's at least. She kept a diary all through her life and with her gift of writing she has preserved to us all, the

†The Right Reverend William P. Remington, D. D., Oregon.

activities and thoughts of those days, illustrated by photographs she took herself, developed and printed by her own hand. Never was a mother more energetic, her vital supply seemed inexhaustible.

After her husband's death in 1918, she spent her time in visiting her children. She loved to be off on a journey and no perils of the road ever daunted her courageous spirit nor prevented her from standing on the edge of a precipice if she could take a photograph of some scene which appealed to her keen sense of nature's loveliness. I remember well only three years ago carrying her on my back over a log jam at Lost Lake, because she wanted a picture of Mt. Hood, reflected in the water. No buckaroo could have ridden a broncho more gaily or with more active spurs as I can testify. It was just this venturesome spirit with its love of fun and life which endeared her to everyone who knew her. Now she is off on the most adventurous journey of all and she will love it and its wondrous new experiences, while her inexhaustible spirit renews itself at Eternal Springs. How we shall miss her, but we would not recall her from the journey.

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# ABSTRACTED AND REPRINTED ARTICLES

## SODA, NICOLAS LEBLANC, AND THE FRENCH REVOLUTION*

**By Prof. T. S. Patterson, Ph. D., D. Sc.**

IN THE NORTH OF AFRICA, south of Tripoli, there occurs native, a double salt of sodium carbonate and sodium bicarbonate, of formula $Na_2CO_3.2NaHCO_3.2H_2O$. This substance was presumably known to the Egyptians and, through them, to the Israelites whose name for it was "nether"—which was either the Egyptian word itself, or was derived from it. This word passed into Greek as "nitron" and into Latin as "nitrum," connoting the same substance. It also passed, apparently through the Greek, into Arabic as "natrum" or "natron," which become shortened to "tron"; and "trona," derived from this, is quite a modern European name for the com-

*Reprinted from *Proceedings of the Royal Philosophical Society of Glasgow.*

pound. The substance was imported, until comparatively recent times, for washing purposes and for making glass.

It was doubtless also known at a very early date that the ash obtained by burning sea-weed had very similar properties. When the Arabians settled in Spain about 700 A. D., they either introduced, or they encouraged the cultivation of, a seashore plant, whose name was probably "kali," which in turn may have been derived from a Hebrew root meaning to burn. The ash of this plant is particularly rich in soda, and to the ash the name "kali" or "alkali" [1] was transferred, presumably by the Arabians who took up the study of alchemy, possibly deriving it from the Egyptians. It was vigorously prosecuted by Geber who is thought to have flourished at Seville about 760 A. D.

At any rate the word "alkali" occurs first in the (Latin translations of the) writings of Geber, where also the word soda is used for the first time in exactly the same sense.[2]

It was known, also at an early date, that the ashes of land plants yielded a substance similar to that from sea plants. But to the Egyptians with their supply of trona and to he Arabians in Spain, with considerable quantities of sea-weed ash and the ash of the plant kali, the ash containing sodium carbonate was probably commoner than the ash containing potassium carbonate. The Arabians may also have added, to the methods of producing alkali, the charring of argol or tartar, the potassium hydrogen tartrate which separates on the sides of the casks when grape juice is fermented (Kopp, iv., p. 5). The words natrum, kali and soda were all applied to any of these products, and at the most, might be used to differentiate between sources, or methods of preparation.

Then in the 13th century the name sal nitri came to be used for potassium nitrate, in place of sal petrosum (Kopp, iii., p. 221), and this was shortened into nitrum and ultimately became nitre, in English; but the words "kali" and "natron" continued to be used indiscriminately for potassium carbonate or sodium carbonate. This new use of the words "nitrum" and "nitre" led to some confusion as

[1] In modern times this was ousted by a native Spanish name for the plan—which was then transferred to the ash—"bariglia"—in the seventeenth century and "barilla" at the end of the eighteenth, and in the nineteenth century.

[2] Kopp: *Geschichte der Chemie*, iv, p. 35.

It is very remarkable that nothing appears to be known of the origin of the word soda, one of the commonest in modern chemistry. Avicenna (980-1037) treats of soda, which he says is the juice of a plant "sosa" (Thomson: *History of Chemistry*, I, 138) but whether he uses the name "soda" or not I do not know.

is indicated by two passages of the authorized version of the Bible,[3] in which the translators did not distinguish the Hebrew "neter," and its equivalent nitrum and nitron, of Latin and Greek, from the comparatively modern word "nitre." Attention was first directed to this by Robert Boyle in 1680,[4] who took some trouble to obtain Egyptian nitre and compare it with ordinary saltpetre.

The development of the chemical idea of salts led to the suggestion of a basis for a common salt, and by the investigations of Stahl in 1702, Duhamel in 1736, and Margraaf in 1759, it was recognized that this basis—what we call base—was the same as the alkali derived from trona and from the ashes of sea plants, but different from that obtained from land plants and argol. This brought about the separation of the alkalis into vegetable and mineral, Guyton de Morveau[5] afterwards introducing the terms, potash and soda, for the caustic alkalis. Of the mild alkalis, the vegetable one, potassium carbonate, was the cheaper.

But, since civilization was progressing, and since what we call civilization depends largely upon soap, both alkalis were becoming necessary in a continually increasing quantity, whilst the supply, especially of soda, did not keep pace with the demand.[6] Naturally, therefore, whenever it was discovered that sea salt and soda were derived from a common basis, many attempts were made to prepare the latter valuable product from the former cheap one.

This was the condition of affairs when at Yvoy-le-Pré, in the year 1742, Nicolas Leblanc made his appearance in this rather casual world.[7] Little is known of his youth. His father, who was the manager of a forge at Yvoy, died in 1751, from which time until 1759 he was under the protection of a M. Bien, an eminent surgeon of Bourges, who died in that year. This connection probably decided Leblanc's choice of a profession; about 1760 he became a pupil at the school of Surgery under Brasdor at Paris. There Lavoisier, Vauquelin, Haüy Fourcroy and others were his contemporaries, in fact nearly all of that school of young French chemists, who, following the

[3] Prov., xxv, 20; Jer. ii, 22.

[4] Experiments and Notes about the Producibleness of Chymical Principles, p. 30; Works, 1725, Ed. III, 371; 1744, Ed. I, 381.

[5] *Jour. de Physique*, 1782, *19*, 379.

[6] So that soda was sometimes even prepared from potash by the action of sodium sulphate, and then crystallisation (Hagen: Kopp, IV, 38).

[7] I am indebted for many details of Leblanc's life to the book by Anastasi (Leblanc's Grandson): "Nicolas Leblanc" (Hachette, Paris, 1884).

lead of Lavoisier, and seizing on the facts accumulated by the somewhat embarrassed Phlogistians, succeeded in changing the old order and in establishing what they proudly called—although not much to the liking of Lavoisier [8]—"La Chimie Française."

Leblanc, after becoming a master in surgery, practised in Paris, and in 1780 became surgeon to the Duc de Chartres who in 1784 became Duke of Orleans. Here Leblanc was the colleague of Berthollet [9], who was physician to the Duke, until he also gave up the practice of medicine and devoted himself entirely to chemistry.

This Duc de Chartres must have been of great importance to Leblanc and Berthollet; and Leblanc and Berthollet, as his surgeon and physician respectively, were probably of great importance to him; and although Carlyle's portrait of the Duc is hardly flattering, let us credit him with his assistance of Leblanc. Amongst other idiosyncracies, he dabbled in chemistry, and in his establishment Leblanc was able to work congenially.

It has already been remarked that the necessity for sodium carbonate was becoming ever more pressing, and various processes for its production on the large scale had been attempted. Scheele, in 1775, had proposed the action of sodium chloride solution on lead oxide, $2NaCl+PbO+H_2O=2NaOH+PbCl_2$, which in itself indicates the value of soda at the time if lead oxide could be used for its preparation. An attempt to work this process on a manufacturing scale was made by Kirwan in England in 1782 (Kopp, iv., 38).

Another process was suggested by Scheele in 1779, depending upon the action of iron, or iron and lime, on sodium chloride solution. $12NaCl + 4Fe + 3O_2 + 6H_2O = 12NaOH + 4FeCl_3$. This was tried by Guyton de morveau in 1783 (Kopp, iv., 38, 39) and was still in operation in 1794.

In 1658, Glauber, in his "De Natura Salinum," had described the "Sal mirabili Glauberi," the residual product in the preparation of hydrochloric acid, a salt which was regarded as miraculous, partly because it had medicinal properties, and partly because it was supposed to dissolve carbon, since, when strongly heated with carbon, the product (sodium sulphide) was soluble in water. In 1777, Père

[8] Oeuvres de Lavoisier: II, 104. "Cette théorie n'est donc pas, comme je l'entends dire, la théorie des chemistes français, elle est *la mienne*, et c'est une propriété que je réclame auprès de mes contemporains et de la postérité."

[9] T. Thomson: "History of Chemistry," II, p. 141, says Berthollet was physician to the *father* of Egalité.

Malherbe suggested the action on sodium sulphate of a mixture of carbon and iron which yielded a product containing sulphur, sodium and iron, which deliquesces in air, taking up carbon dioxide and yielding some soda. About 1777 [10] de la Métherie (Journ. de physique, 1789, *34*, 44) had proposed to calcine sodium sulphate with carbon, supposing that sulphuric acid would be decomposed to yield sulphurous acid and leave pure soda behind. He also proposed that part of the product, a hepar of sulphur (sodium sulphide), might be treated with acetic acid or other vegetable acid to give acetate of soda which on calcination would yield soda.

But these were not satisfactory processes, and, about 1782, the economic production of soda had become so important that the Academy offered a prize of 12,000 (24,000 Kopp) livres for a good process. None of those then available was adjudged to be of sufficient merit.

It may possibly have been the offer of this prize, or it may have been merely general scientific interest which attracted the attention of Leblanc; indeed the problem was one likely to fascinate any chemist, capable of appreciating the enormous possibilities of such a manufacture. The raw material very cheap (except for the Gabelle—salt tax —see p. 129) and easily obtained; the finished product, expensive, absolutely essential and used in great and continually increasing quantities—in consequence of which the price was steadily rising. France, it has been estimated, paid to foreign countries—chiefly to Spain for barilla—no less than 30,000,000 fr., which, considering the value of money at that period, was a very considerable sum.

Leblanc commenced his experiments in this direction in 1784, but we hear nothing of them for some time. Simultaneously with them he was busy with others. In 1787 he published a research on the crystallization of neutral salts [11] (Journ. de phys., 1787, *31*, 29), (see also J. de phys., 1788, *33*, 374); and another on cubic alum and cobalt vitriol (ibid. *31*, 241); in 1788, one on spontaneous combustion of oil; and, in consequence of a great fire which had broken out spontaneously, he also carried out comparative analyses of French and English coal. He gave, then, at this time distinct evidence of becoming an important scientific worker, and the successful result of his experiments on the production of soda was apparently not due

[10] Anastasi, 171.

[11] Shortly before the end of his life, when his affairs were at a very low ebb, he published another paper on crystallisation, a subject which apparently had special attractions for him. *Jour. de phys.*, 1802, *55*, 300.

to a fortunate chance, but to carefully conducted and intelligent research.

Leblanc, recognizing that the processes already in existence were either incomplete or too expensive, succeeded in overcoming all the difficulties and rendering the process one of very considerable simplicity by merely fusing the sodium sulphate and carbon with the addition of calcium carbonate, much the cheapest and best method of supplying the requisite carbon dioxide.[12]

The year 1789, which saw the completion of his labors, also ushered in the Revolution; and the extraordinary events of the year or two preceding and of those following, must have had a special interest for Leblanc on account of the part played by his patron. In the meantime things probably went well enough, for Orleans was antagonistic to the King and was trying to ingratiate himself with the people.

Leblanc suggested to the Duke of Orleans in 1789, the operation of his process on the large scale. Orleans requested the advice of d'Arcet, Professor of the Collège de France, and tests were carried out by one, Dizé, who was préparateur there, and who thus came into contact with Leblanc. D'Arcet's report was very favorable (Anatasi, 17) and on the 12th of February, 1790, an agreement was signed before John Lutherland, a public notary, in London, between the Duke of Orleans, Leblanc, Dizé, and Henri Shée, the last being Orleans' agent. This agreement was in respect of the loan by Orleans of 200,000 livres (tournois) to work Leblanc's process as well as a secret process by Dizé for making white lead, and one for making sal ammoniac, a description of the processes being deposited on 27th March, 1790, with a notary at Paris, accompanied by a certificate from d'Arcet (dated 24th March, 1790) stating it to be the process which had already been tested by him (Anastasi, p. 180). It seems strange that this agreement should have ben signed in London, but this was probably because the Duke of Orleans—who aimed at the throne; who was hated by Marie Antoinette; who had deliberately encouraged the revolutionary element, and had joined the National Assembly (Tiers Etat), June 25th, 1789—had found it convenient to

[12] He regarded it himself as the completion of the process of de la Métherie of 1789 (De la Métherie, *Jour. de Physique*, 1789, *34*, 44; 1809, *69*, 442; Anastasi, 175. In the second reference a quotation from a Mémoire of 1798 by Leblanc is given.

leave France;[13] and seek change of air in London (October, 1789—July, 1790), where in any case he had often visited. He was an intimate friend of the Prince Regent—afterwards George IV—a friendship not calculated much to improve the morals of either high contracting party.

At this time the Gabelle was in existence, and, of course, must have had a serious effect upon an industry depending upon sodium chloride. The tax varied in different parts of France, but Paris was situated in the Pays de Grande Gabelle, where everyone over eight years of age was assumed to use nine pounds per head per annum, the duty on this being assessed at 62 fr. per quintal. This tax was reduced on September 23d, 1789, and abolished on March 26th, 1790,[14] which, naturally, much simplified the problem of the manufacture of soda.

Then on 27th January, 1791, an association was formed between Nicolas Leblanc (soda), Michael Jean Jerome Dizé (white lead), and Henri Shée (representing Orleans), and a factory was established at St. Denis. Orleans was to get 10 per cent. interest on his money, and Leblance, at least 4000 livres per annum; Dizé, 2000 livres, if the profits should not otherwise reach these amounts.[15]

Meanwhile the Constituent Assembly, in 1791, passed a patent law guaranteeing to inventors a fifteen years' monopoly. Leblanc at once took advantage of this, and the fourteenth patent under the new law was accorded to his process.[16] The works were now in full activity and were turning out five to six hundredweight of soda a day.

About this time the prevalent political excitement was beginning to infect scientific bodies, and Lavoisier—who had been drawn into politics at an earlier date, and who was perhaps the most prominent scientist in France at the time—became, as a landowner, the object of an altogether unmerited suspicion. It was not long until the Convention began to suspect the Academy—of which Lavoisier had become Treasurer in 1791[17]—of "incivism." Fourcroy, who had been associated with Lavoisier in earlier years, moved in Spring,

[13] Cambridge Modern History, 1909, VIII, 185.
[14] *Loc. cit.*, pp. 696, 697.
[15] Anastasi, p. 184.
[16] Anastasi, pp. 19, 185.
[17] Grimaux: Lavoisier, 1888, p. 148.

1792, that members suspected of "incivism" should be expelled, and although the proposal was rejected for the moment, it was clear that danger threatened. On August 10th, 1792, Vernigaud, in the Legislative Assembly, and at the Dictation of the Commune, proposed the summoning of a National Convention, and on September 5th Robespierre, Danton, Marat, Camille Desmoulins, David [18] and others were elected for Paris, along with Orleans—who owed his election to Jean Paul Marat [19]—as the last member. On the 15th September of the same year (1792), by permission of the Commune, Orleans changed his name to Philippe Egalité.

At this time, shortly after the establishment of Leblanc's factory, France, in addition to her internal troubles, was becoming involved in difficulties with other powers. The terrible September 2nd massacres, the establishment of the Republic "one and indivisible" (1792), the success of the French arms at Valmy (September 20th) and Jemappes (November 6th), produced a general confusion and frenzy, which was no way allayed by the trial of Louis VI in the last days of December, 1792, and the first days of January, 1793. By the vote he then gave Orleans became a regicide and Louis died on 31st January, 1793. This naturally increased the prevailing confusion which was added to by the declaration of war against Britain (February 1st), against Spain (March 9th) and the declaration by the Empire against France on March 22nd.

These were exciting times in which to work out a new industry, and to Leblanc they must have been particularly so. The popularity of his patron soon began to wane; but, on the other hand, since France was now at war with almost the whole of Europe, she had cut herself off completely from the main sources of soda, especially from Spain, although possibly a little may have been produced from sea-weed along the coast. This might not have mattered so much, had it not been that the supply of potash also was insufficient, and was all used up immediately in the preparation of nitre for gunpowder. Strenuous efforts were made to utilize the resources of the nation. Chaptal was brought to Paris to act as director of the powder factories. All the leading scientists were occupied with state matters. It was a condition of affairs which we, casting our mem-

[18] The painter of the well-known picture of Lavoisier and Mme. Lavoisier.

[19] A physician (M. D., St. Andrews, June 30, 1775). *The Encycl. Britt.* (9th Ed.) gives Marat a fairly good character. Grimaux (*loc. cit.*, pp. 206, 207) does not.

ories back a few years, are not unable to understand. So far, the success of the manufacture of soda had been considerable, but as the result of the economic conditions, prices all round began to rise, and that of soda, on account of its increasing scarcity, rose from 40 fr. per quintal (100 lbs. or 50 kg.) to 75 fr. and then to 110 fr. To stop this natural result of the general conditions, a law was passed (3d May, 1793) which decreed a fixed maximum price for all commodities, a measure—as again we have had reason to know—tending naturally to still further chaos.

This, of course, rendered the management of the three-year-old factory much more difficult, and reduced Leblanc to financial embarrassments, which may seem strange as the manufactory had apparently been paying well; the profits had perhaps been largely devoted to extending and improving the works. At any rate, in 1793, his two daughters opened a small milliner's shop in the Rue St. Antoine, before the door of which the tumbrils soon rolled gaily, daily; for, about this time, Robespierre was getting well into his stride. On April 6th, 1793, the Duke of Orleans was arrested and thrown into prison.

Shortly afterwards, on the 13th July, 1793, Marat, who in his paper "L'Ami du Peuple" had been pouring out denunciation on Lavoisier, was picturesquely assassinated by Charlotte Corday d'Armans, who, in anticipation as it were, avenged Lavoisier and many others, but paid four days later her own expiatory visit to the Place de la Révolution. Thus as Carlyle remarked, "the beautifullest and the squalidest come in collision and extinguish one another." But although Marat was dead his work went on and what he had desired was accomplished. On the 8th August, 1793, the Convention decreed the suppression of all the learned societies of France.

This had its effect upon Leblanc, for he either was or might have been—I have been unable to discover for certain—a candidate for the prize of 12,000 livres, which the Academy had proposed in 1782. His process was now in full working order. He had fulfilled all the necessary conditions. The prize could hardly have been adjudicated otherwise than to him, but the Academy no longer existed to award it.

With the advent of the Terror in October, 1793, the Dance of Death became wilder than ever. On the 16th October, Marie Antoinette was executed. On the 29th Orleans was tried and condemned, and on 6th November he was executed. It was known, of course,

that Orleans had been interested in the factory at St. Denis, and since the Republic had proclaimed itself heir to all the property of condemned or executed prisoners, Leblanc's factory was instantly sequestrated and work there was interrupted, which naturally caused the stoppage of other industries which were dependent upon soda. As there was no other factory capable of anything like the same production, this was a disaster of the first magnitude.

And still the work of Marat was carried on by Fourcroy, who, apparently out of fear, seems to have directed his energies against Lavoisier, and it is said to have stigmatized him as a counter-revolutionist.[20] Therefore, in November, the Convention ordered the arrest of Lavoisier, and, with other Fermiers Généraux, he was placed in the prison of Porte-Libre. This again, had a direct influence on Leblanc for on 7th January, possibly on the recommendation of Chaptal, he was appointed "régisseur des poudres et salpêtres à l'Arsenal," in succession to Lavoisier. The pressing necessity for soda soon made itself felt, and the Committee of Public Safety issued an appeal to all patriots, to place at the disposal of the Nation, any secrets or inventions likely to prove advantageous to it. Not to have replied to such an appeal would have been dangerous indeed. Shée was apparently the first to realize this. In February, 1794, he wrote from St. Denis, where he was in charge of the factory, to Leblanc, who, on account of his office, had to live in Paris—at the Arsenal: "Your patriotism will suggest to you at once I am sure the sacrifice of your secret, the fruit of your long and laborious researches. . . . Nevertheless, thinking that your sense of honor might occasion you some scruples in regard to the enterprise, I hasten to assure you for my part—from my heart—that I consent and even invite you if it be necessary, to reveal to the nation all that you know of this important subject. . . . I am persuaded that Citizen Dizé will find in his patriotism all the motive necessary to approve this step." Leblanc gave up his secret and his process was published [21] in pamphlet form, together with a few more by Malherbe, Chaptal, Guyton de Morveau, and others. It was described fully, with plans and complete practical details, together with a report upon them all, which highly praised that of Leblanc, and added that "Citizens Leblanc,

[20] See Grimaux, Ch. VII, and Thomson's History, II, pp. 169-170. T. E. Thorpe: "Essays in Historical Chemistry," 1902, pp. 140-147.

[21] See *Leblanc:* "Observations sur la confection et l'usage de la soude." *Ann. Chim. Phys.*, 1804, *50*, 96.

Dizé, and Shée, co-associates, are the first to present their memoirs and have shown a noble devotion to the public welfare. . . . The process of Citizen Leblanc by the use of chalk, appears to us that which might be generally adopted."

At the same time the factory was seized—and sold! and Leblanc, the man of all men best able to carry on the work, was expelled (February, 1794). He probably expected that he would at least be continued in the management of the industry he had created.[22]

On April 5th, 1794, Camille Desmoulins and Danton died in company, and very soon afterwards the stage was set for the tragedy of Lavoisier. In spite of much influence which was put forth on his behalf, the Terrorists under Robespierre, had their way, and on 2nd May, 1794, Dupin, in the Convention made charges against all the ex-Fermiers-Généraux, who were accordingly brought to trial on 6th May, 1794. Here, Fouquier-Tinville was the prosecutor; and Jean Baptiste Coffinhal, the president, is said to have rejected contemptuously the memorial on behalf of Lavoisier—who had asked for a respite of fourteen days in order to finish the research he was engaged on—with the words "La République n'a pas besoin de savans ni de chymistes; il faut que la Justice suive son cours." But there is some doubt about both Lavoisier's request and Coffinhal's words.[23] There was such a hurry to do away with them that the jury's decision was omitted from the minute of judgment—these were not times for worrying about trifles; on the 8th they were all executed. Very possibly Madame Defarge was there with her knitting and, if so, she counted "four" as Lavoisier's head fell, unless indeed, Miss Pross had squared accounts with her before this period. Head number three belonged to M. Paulze, Lavoisier's father-in-law. Poor Mme. Lavoisier! It afterwards became part of Leblanc's duties to make an inventory of Lavoisier's effects.[24]

By the end of June the Terror was at its most terrible, but poetic justice saw that her opportunity had come at last, and Robespierre followed his victims to the guillotine on the 27th July, 1794. With his death, the worst was over. It remained, however, to do a little clear-

[22] Anastasi. p. 27.

[23] Grimaux, p. 376.

[24] It is interesting to observe that of the scientists of the time, Berthollet seems to have been the only one regarded as so necessary to the country that he could dare to be independent. See Thomson's "History of Chemistry." II, pp. 144-145.

ing up. Coffinhal was arrested and executed on the 5th August, 1794, and less than a year later, on the 7th May, 1795, Fouquier-Tinville suffered the fate which he so richly deserved.

Whilst the Revolution was at its height and the law of the maximum in force, it was no wonder that industries of all sorts had ceased to flourish, the mineral industry particularly being at a standstill. But when the Terror had passed and some sort of desire for regularity and order reasserted itself, the question of the industries was one of the first to attract notice. Leblanc was sent (June, 1795) by the Committee of Public Safety to examine and try to revivify the alum mines at Tarn and Aveyron, and there he spent thirteen weary months at his own expense.

On his return he was offered in December, 1796, a Professorship of Natural History at Alby, which he declined. In spite, however, of his pecuniary embarrassements and other worries, he contrived to carry on some scientific work, and presented a paper on nickel to the Lycée des Arts in 1798.[25]

He enters now upon the last phase of his career which consisted, as not infrequently happens in such cases—little Miss Flitte for example—of a constant presentation of petitions to the authorities for recognition of his rights; petitions which seem never to be successful. When the world has wronged an individual, it appears to be a law of nature that the proper reward for him is to heap indignity upon wrong and neglect on both; to stamp him out; to get rid of him. He applied for the restitution of his works and Neufchateau promised 3000 fr. as recompense, of which, however, he only received 600 fr. Prompted by Fourcroy, who now seems to have stood his friend, he made other applications for payment of the remainder. These were answered by Quinette, Chaptal and Berthollet in succession, always with the same excuses. The Republic acknowledge its indebtedness to Leblanc, but on account of the war there was no money to pay. Resuming his petitions, he cited his services to the State, and at last in April, 1801, a decree of the Minister of Finance sellor of State), and Dizé (now physician-in-chief to the military hosordered the restitution of his works; Shée (who had become Counpitals), both declined to have anything further to do with the factory. Leblanc therefore made a start himself, but he had very many diffi-

[25] Reported on by Deyeux: *Ann. Chim. Phys.*, 1799, *31*, 274. Rapport fait à la classe des sciences mathématiques et physiques, le 6 thermidor, an 7; 24 July, 1799.)

culties to contend with. He had to compete with other factories working his own process, and with obvious advantages over himself. He no longer had a monopoly.

In July, 1801, he writes to one of his daughters: "My factory progresses in spite of many obstacles, which depend on the rapacity of the money-lenders. But I hope some time hence to do a profitably large trade. . . . I am again in a state of penury which does not permit me to do for you as I would." In September he was in good spirits and hopeful again. "You will find the factory in operation; I have made several charges of good soda, the Prefect of the Seine has samples of them for examination." [26] He was forced to borrow money, but with nothing to offer except the probable profits of his factory, he had to pay very high interest, and day by day the situation became worse, so that in 1803 he applied to the Société d'Encouragement for assistance, which made him a grant of 2000 fr. This was not enough to save him, nevertheless he still had sufficient courage and energy to attempt to retrieve his fortunes by turning his attention in the direction of the use of ammonium salts for manure.[27] But, although his cheme was favorably reported on by Vauquelin, Fourcroy and Deyeux, a patent he had applied for was not granted, and after this new disappointment he had thoughts of offering his inventions to the Russian Government. If he ever carried out his intention this also came to nothing, and he made one final effort to obtain adequate compensation from the Government. At last, in February, 1805, the Prefect of the Seine issued a decree submitting his document of 1803 to arbitration. Leblanc's calculations of losses due to confiscation of the factory, interruption of work during nearly seven years, loss of monopoly due to publication of his patent, and on the manufacture of sal ammoniac and white lead, amounted to about £100,000, and this, at a modest calculation. To this memorial were attached several declarations relating to these losses, of which one at least deserves to be mentioned. It was that of M. Payen and Debourlier who attested that the process carried out in their soda factory, which was also situated in St. Denis, was that of Leblanc and was due enitrely to the publication of the patent; "this statement being made," they said, "with the desire that the enlightened and excellent man to whom the process was due might profit by it." All honor to

[26] Anastasi, 97, 100.

[27] He published a report on the fabrication of ammonium chloride in *Jour. de Phys.*, 1800, *50*, 462.

them! For ten months Leblanc had to wait as patiently as might be for the final decision of his fate. At length on 8th November, 1805, the report of the arbitrators was published. What Leblanc had valued at £100,000 they estimated at £4660, of which Leblanc's share, after subtracting sums due to the Government on Orleans' account, would be about £2000, the reward of twenty years' of toil and of the founding of one of the most important industrial processes of a whole century. The arbitrators could easily have afforded to be more generous, for nothing, even of their small award, was ever paid.

This final blow was more than Leblanc could bear. His powers diminished; he lost his fortitude; he became morose, and absorbed in his wrongs and his misfortunes; he deserted his laboratory and passed the day, and much of the night, in the constant writing of letters, petitions and memorials, but at last in the early morning of 16th February, 1806, he cut himself adrift from worldly cares by means of a pistol bullet. Leblanc, who had filled many public posts during the storm of the Revolution, who had placed all that he possessed at the service of his country, who had given to France a new and great industry; had been driven, through disappointment, to despair of human sympathy, pity and justice, and had sought relief on the other side of time.

Owing to the stirring events of the time his death passed unnoticed. His family was much reduced in circumstances and continued to make petitions to the authorities. His widow applied to Josèphine, "la mère des Français," but Josèphine, who had, perhaps, her own worries at home, took no notice. Another application furthered by friends, was made on 1st August, 1806, for payment of the indemnity, but this also was rejected. The restoration of the works was held to be sufficient.

Finally, the works were sold again and the money, 25,000 fr., given to Dizé, who had never expected anything from them, who was already well enough off, and who was willing to treat the memory of Leblanc so scurvily, that, in 1810, he published a historical account claiming the credit of Leblanc's discovery, a claim which was reported upon and rejected by La Rochefoucauld on 2nd September, 1819.[28] As late as 1852, Dizé published another note on the discovery of the method of preparing soda, again claiming the credit for it, but Leblanc's family on 17th November appealed to the Emperor (Napoleon

[28] Anastasi, p. 200.

III) and all the necessary documents—the agreement between Leblanc and Dizé, the act of association, and the documents relating to Leblanc's patent—were handed to the Academy for investigation. On 30th November, 1855, Dizé's family at once made a counter-claim which was the cause of a thorough examination of the evidence, a review of the matter being published in the Comptes rendus (Sitting of 31st March, 1856), the report being made by Thénard, Chevreul, Pelouze, Regnault, Balard, and Dumas as secretary. This report was wholly in Leblanc's favor, and his claims would now be universally recognized. Hofmann at the great Exhibition of London in 1862, spoke of "this man, who was certainly one of the greatest benefactors of humanity (who) lived in poverty and died of despair," and Dumas on the 23rd July, 1883, gave it as his opinion that "all that Leblanc has done can only be equalled by the discoveries of Watt in engineering. Of all men, the two who have done most for the welfare of mankind, are undoubtedly Leblanc and Watt."

Thus Leblanc received his reward in the end, and occupies henceforward an honored niche in the temple of fame.

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## NOTES ON REINSCH'S TEST *

**Henry Leffmann and Max Trumper**

MANY SCIENTISTS have obtained immortality simply by their names being indissolubly connected with some procedure, apparatus or phenomenon. Baumé, Nicol, Fehling and Kjeldahl are familiar instances. Soxhlet has undeserved and unsought fame, for the useful extraction apparatus was devised by an assistant, Szombathy, as Soxhlet states in a communication (*Ding. Polyt. Jour.*, 1879, *232*, 461). Bunsen is not a case in point, for while his burner is so familiar that his name is often spelled with a small "b," his work on the kakodyl compounds and in spectroscopic and gas analysis is widely known.

Hugo Reinsch was a chemist who contributed considerable information, but his name appears in modern literature only in connection with a test. Witthaus and Wormley, in their respective works on toxicology, give 1843 as the year of the publication, but this date

*Advance sheets *Bull., Wagner Free Inst. Sci.*, 1927, *2*, 89.

refers to a book on arsenic. The original publication was in *Jour. prakt. Chem.*, 1841, *24*, 244. He discovered the reaction by accident. Boiling a copper slip with commercial hydrochloric acid he noted a discoloration and on investigation found that the acid contained arsenic. We might speculate on what delay would have happened in the introduction of this test if the acid had been pure. The reaction suggested trials with other metals and the paper contains the results of numerous experiments. In modern use the test is practically limited to detection of arsenic, antimony and mercury, particularly the first named.

The test has not received the attention from toxicologists that it deserves. This has been largely due to a lower delicacy than some of the other tests, especially Marsh's and the modifications thereof, depending on the production of hydrogen arsenid. In the detection of very minute amounts of arsenic and antimony, Reinsch's test is not satisfactory, but in dealing with ordinary cases of poisoning, it serves a very useful purpose, because it can be applied directly to almost all materials that may be presented to the toxicologist, such as secretions and excretions, vomited matter, viscera, foods and beverages. Preliminary destruction of the organic matter is not required. The coating on the copper is fairly characteristic when the metal is present in the pure state, but in the ordinary application of the test, confirmation of the nature of the deposit must be made. This is fortunately easily carried out as far as regards arsenic, antimony and mercury, which are the elements with which the toxicologist is almost exclusively concerned in connection with the test. The copper slip, washed and carefully dried, is rolled into a small mass and heated gently in a small glass tube closed at one end. Arsenic sublimes and oxidizes to arsenous oxid which deposits on the cooler portion of the tube in brilliant octahedral crystals. Mercury passes into vapor without oxidizing and collects in mirror-like globules. Antimony on strong heating gives a sublimate which shows needle-shaped forms in part, but under moderate powers is largely amorphous.

The production of octahedral crystals was long considered as definite evidence of arsenic, but in 1877 Dr. Wormley communicated to the *American Journal of the Medical Sciences* the results of numerous experiments in which distinct octahedral crystals had been obtained with pure antimony compounds. This communication is republished in *Amer. Jour. Pharm.*, 1880, *52*, 195. It appears that strong heating and moderate exposure to air were employed. This is

not the proper method of testing the slip. It should be heated with a spirit lamp and in a narrow tube closed at one end. Under these circumstances the formation of brilliant octahedral crystals without appreciable deposit of another character will be proof of arsenic. The size of the crystals may be increased if the part of the tube just above the copper slip is slightly warmed. This causes the vapor to crystallize rather slowly, which is always favorable to better forms. Reinsch calls attention to the difference between the deposit of antimony and arsenic on the copper, but he did not report any test by sublimation. It is true that by using pure materials an appreciable difference can be noted in the deposits, but in toxicologic work, such difference is often lacking and the sublimation procedure should be employed.

In the practical application of the test, the materials used can be submitted to perfect control, by the following method: Pure thin copper foil, about 3 cm. long and 1 cm. wide, is introduced into a test-tube about 10 cm. long and 2 cm. in diameter. A mixture of pure water with about 10% of pure hydrochloric acid (1.12) is added and the mixture boiled gently for a few minutes. No color should be deposited on the copper. If the metal was somewhat tarnished, it will, of course, brighten by this treatment. By this preliminary test the purity of the acid and copper can be established. A small amount of the solution to be tested is then introduced. Ordinarily there will be no foaming, but care should be used in making the addition. In the presence of even small amounts of such metals as arsenic, antimony, mercury and bismuth, a coating will soon form on the copper. It is of little value to examine this coating, as the subsequent treatment will give more satisfactory results. The slip is removed, washed with pure water and dried with filter paper, or it may be dried on the water bath. It is rolled up or cut in strips and introduced into a clean glass tube which is sealed at one end, the copper being pushed down close to this end, which is then heated gently by a spirit lamp. Bismuth gives no sublimate, mercury produces globules, antimony gives no appreciable effect, unless the heating is long continued, which should not be. In the presence of appreciable amounts of arsenic, the crystals of arsenous oxid can be seen by the unaided eye, but examination with very low powers will show the characteristic forms.

The entire amount of the several metals that respond to this test can be removed from a solution by it, but this is not usually advisable. The crystals of arsenous oxid can be driven back and forth in the tube by gentle heating and thus their nature still further indicated.

Reinsch made some comparative quantitative experiments and stated that the test was as delicate as any then in use, but Wormley did not get such results. It is true that in comparison with the tests introduced in recent years and intended for the detection of the minute amounts of arsenic which are liable to be in foods, beverages and drugs, the test is inferior and, indeed, not applicable, but for preliminary examinatios of materials submitted in such cases of suspected poisoning it is very useful.

The metals less positive than copper are precipitated without the addition of acid, but in many cases the action is hastened by slight acidification. Arsenic is almost always encountered in the negative ion (as arsenite), and action of the strongly ionizing halogen acid is needed to bring it into such relation to the copper as will permit the latter to substitute it. Arsenates do not react well, but large excess of acid will enable some result to be obtained. Oxidizing substances, such as potassium chlorate, interfere completely. Antimony is usually encountered in toxicology in the positive ion, since tartar emetic is the familiar form.

The neglect into which the test has fallen is shown by the fact that it is not mentioned in Autenrieth's manual, which is one of the most popular guides in toxicologic analysis, in its original and translated forms. Trumper's "Memoranda of Toxicology," however, describes the test in detail with the necessary precautions.

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## ISOPROPYL ALCOHOL *

### A VALUABLE SOLVENT AND SUBSTITUTE FOR ETHYL ALCOHOL

**By Harvey S. Garlick**

OF THE NUMEROUS liquids that have been introduced for solvent purposes in recent years few show such interesting possibilities as secondary or isopropyl alcohol. This, although known since 1855, has only during the last five or six years been brought from the position of a laboratory rarity to that of a cheap commercial chemical.

*Reprinted from *The Industrial Chemist.*

In America the examination of the gaseous products of the "cracking" of petroleum has established the presence of propylene and analogous olefine hydrocarbons, which can be converted by a simple process into secondary and tertiary alcohols, the most important of which is isopropyl alcohol. Manufacture in this way is there proceeding on a very large scale. In England and on the Continent increasing quantities are being made by a process involving the catalytic reduction of acetone. As yet, however, the price here is high and only small amounts have been used in industry.

It is the purpose of this article to draw attention to the valuable properties of this alcohol and advocate its manufacture and use here on a much larger scale.

## Occurrence

Normal propyl alcohol occurs to the extent of about 20 per cent. in fusel oil, and although isopropyl alcohol has been reported to occur there also, this seems doubtful, except where the fusel oil has resulted from the fermentation of potato meal.

Isopropyl alcohol was first prepared by Berthellot in 1855 by combining propylene with sulphuric acid and distilling with water. It was then, however, assumed identical with the propyl alcohol obtained from fusel oil. In 1862 Berthellot prepared it from acetone, and in 1863 Kolbe recognized this substance as the first of a class of secondary alcohols the existence of which he forecasted.

The propyl alcohols possess the general formula $C_3H_7OH$. The normal form possesses he usual straight chain, $CH_3.CH_2.CH_2.OH$, whilst the secondary isomeride has the formula $CH_3.CH(OH).CH_3$.

## Preparation

Numerous methods for the preparation of isopropyl alcohol are available such as:

(*a*) Reduction of acetone in aqueous solution or by passage of the vapor with hydrogen over a nickel catalyst

$$CH_3.CO.CH_3 + 2H = CH_3.CH(OH).CH_3.$$

(*b*) Action of acetaldehyde on a dry ethereal solution of methyl magnesium iodide, and treating the product with water or dilute acid

$$CH_3.CH : O + CH_3.MgI = CH_3.CH(OMgI).CH_3$$

$$CH_3.(OMgI).CH_3 + H_2O = CH_3.CH(OH).CH_3 + I.Mg.OH.$$

(*c*) From glycerol through the intermediate formation of isopropyl iodide by distillation with phosphorus and hydriodic acid, then hydrolysis with water or shaking with aqueous lead hydroxide.

$C_3H_5(OH)_3 \rightarrow C_3H_7I \rightarrow C_3H_7.OH.$

## Chemical Properties

Normal propyl alcohol has a taste and smell like ethyl alcohol, but isopropyl alcohol has a distinctly stronger though not unpleasant smell, more like butyl alcohol, and a slightly bitter taste. It is a stable and colorless liquid, and strongly resembles ethyl alcohol in its solvent powers and miscibility in all proportions with water, but it has a higher flashpoint and is slightly less volatile. Isopropyl alcohol is insoluble in salt solutions and may be recovered from aqueous mixtures by "salting-out" with sodium chloride, caustic soda, &c.

### Isopropyl Alcohol

| | | |
|---|---|---|
| Boiling Point | at 760 m.m. | 82.4° C. |
| Specific gravity | at 0°/4° | 0.8012 |
| " " | at 15°/15° | 0.7903 |
| " " | at 20°/4° | 0.7855 |
| Refractive Index | at 20° | 1.37757 |
| Freezing point | .. | —85.6° C. |
| Critical temperature | .. | 234.9° C. |

For comparison, the following figures are included:—

| | Boiling Point at 760 mm. | Specific Gravity at 15.5°/15.5° | Refractive Index at 20° |
|---|---|---|---|
| Ethyl alcohol (99.5 per cent.) ..... | 78° C. | 0.7961 | 1.3618 |
| Normal propyl alcohol ..... | 97° C. | 0.8098 | 1.3855 |

Isopropyl forms the following constant-boiling mixtures in which the percentages are given by weight:—

| | per cent. | |
|---|---|---|
| Isopropyl alcohol | 18.7 | Boiling point, 66.51° C. |
| Benzene | 73.8 | |
| Water | 7.5 | |
| Isopropyl alcohol | 33.3 | Boiling point, 71.9° C. |
| Benzene | 66.7 | |
| Isopropyl alcohol | 87.7 | Boiling point, 80.35° C. |
| Water | 12.3 | Specific gravity of this mixture at 20°/4°, 0.8158. |
| Isopropyl alcohol | 52.3 | Boiling point, 80.1° C. |
| Isopropyl acetate | 47.7 | |

Isopropyl alcohol possesses the great advantage over ethyl alcohol in that it is much easier to dehydrate, slight digestion with caustic soda and subsequent distillation giving a practically anhydrous product.

Whereas normal propyl alcohol yields propaldehyde $CH_3.CH_2.CHO$ on mild oxidation, isopropyl alcohol gives acetone $CH_3.CO.CH_3$. Ovidation with alkaline permanganate causes complete disintegration, carbon dioxide, oxalic and acetic acids resulting.

Isopropyl alcohol along wth ethyl alcohol, acetone and acetaldehyde gives a positive reaction with the iodoform test. A characteristic of the alcohol, however, is its benzoic ester (isopropyl benzoate) which on distillation is completely decomposed into propylene and benzoic acid. As other alcohols its forms a crystalline compound with aclcium chloride. It is a non-solvent for cellulose nitrates and acetates, but an excellent solvent for camphor and its substitutes, and dissolves shellac and the softer resins to give clear transparent solutions.

According to Lebo (*J. A. C. S.*, 1921, 1005) the specific gravities of aqueous isopropyl alcohol are as follows:

| Per cent. alcohol. | S. G. at 20°/4° |
|---|---|
| 10 | 0.9821 |
| 20 | 0.9704 |
| 30 | 0.9521 |
| 40 | 0.9311 |
| 50 | 0.9070 |
| 60 | 0.8826 |
| 70 | 0.8585 |
| 80 | 0.8343 |
| 90 | 0.8097 |
| 100 | 0.7855 |

The coefficient of expansion for 70 to 100 per cent. alcohol is 0.00080 per deg. C.

### Manufacture from Petroleum

In the United States research was initiated about January, 1918, on the commercial utilization of the non-condensable gases produced in the "cracking" of heavy petroleum distillates for the production of

motor fuel. By suitable treatment the olefines contained in these wastes gases are converted into isopropyl alcohol and secondary butyl, amyl, hexyl, heptyl and octyl alcohols. Certain tertiary alcohols are also produced (see *Ind. and Eng. Chem.,* August, 1926, 844).

At the present time three refineries have been adapted to treat these gases, the largest being that of the Standard Oil Company of New Jersey, which commenced production in 1919. The plant of the Empire Refineries at Okmulgee, Oklahoma, built after research by the Doherty Research Company, is described in *Chem and Met. Eng.,* July, 1926, 402. The scope of the process will be realized when it is remembered that one refinery alone produces 12,000,000 cubic ft, of gas daily with an olefine content of 10 to 12 per cent.

The gas is scrubbed with sulphuric acid which removes the olefines in the form of their alkyl sulphuric esters, *e. g.,*

$$CH_3:CH.CH_2+H_2SO_4=CH_3.CH(OSO_3H).CH_3.$$

These on hydrolysis yield the alcohols and sulphuric acid.

$$CH_3.CH(OSO_3H).CH_3+H_2O=CH_3.CH(OH).CH_3+H_2SO_4.$$

Ethylene is one of the olefines present in the gases, but the production of ethyl alcohol is not the aim of the process. Ethylene is only absorbed by concentrated acid at high temperatures or in the presence of a catalyst such as a mercury salt. Propylene and the higher olefines are readily absorbed by weaker acid in the cold, thus by keeping the temperature of reaction reasonably low the ethylene passes through the system unchanged.

The gas from the cracking stills is first purified from sulphur compounds, then compressed, and in the Carleton Ellis process (*B. P.* 146,957, 1920) passed through absorption towers counter-current to a fine spray of sulphuric acid, which is recirculated until the specific gravity falls from 1.8 to 1.3 or 1.4. The acid liquor is then diluted with water and the polymers, higher alcohols, &c., allowed to separate out. The diluted liquor is then steam distilled. A small amount of olefines and propyl ether is first obtained, then isopropyl alcohol and higher secondary and tertiary alcohols. The crude alcohols are purified by suitable treatment with alkaline calcium hypochlorite, alkaline potassium permanganate, silica gel or absorbent charcoal, dehydrated by contact with solid caustic soda and then separated by fractional distillation. The chief product is isopropyl alcohol, which is sold in the United States under the name of "Petrohol."

The secondary butyl and amyl alcohols also obtained possess the following constants:

| | *Secondary Butyl Alcohol* | *Secondary Amyl Alcohol* |
|---|---|---|
| Boiling point at 760 m.m. | 99.5 | 199.0 |
| Specific gravity at 20°/40° | 0.8063 | 0.8088 |
| Constant-boiling mixture with water—boiling-point | 87.5 | Steam distils at 92° C. |
| Alcohol content by volume of above mixture | 77.7 | — |
| Solubility in water | 21.5 per cent. | 4 per cent. |

### Manufacture from Acetone

On the Continent and to a small extent in this country isopropyl alcohol is made by the catalytic reduction of acetone.

The reduction of acetone to isopropyl alcohol at atmospheric pressure in the presence of nickel is slow, especially in the later stages. According to Maxted (*Chem. and Ind. Review,* May 28, 1926) if acetone is distilled in a current of hydrogen at a pressure of 100 atmospheres the mixture being passed over a granular nickel catalyst without reduction of pressure, a rapid production of relatively pure isopropyl alcohol results. The hydrogen must be in considerable excess and best results are obtained when it is recirculated continuously through the system.

The usual process is to use liquid acetone. Commercial acetone free from catalyst poisons is agitated with hydrogen under pressure in the presence of a nickel catalyst. The reaction is carried out under close control in order to eliminate secondary reduction products, which affect the odor and consequent value of the product.

### Physiological Action

Isopropyl alcohol possesses healing properties for wounds, being twice as good a disinfectant as ethyl alcohol. Used undiluted to wash wounds and hands, to harden the skin, &c., no injurious effects have been produced. Exposure to the fumes of the alcohol causes no inconvenience, nor produces any deleterious action on the optical system as does methyl alcohol. Injected intraveneously isopropyl is twice as toxic as ethyl alcohol, but less so than normal propyl alcohol. Its physiological action is comparable with that of acetone to which it

becomes oxidized by metabolic changes. In general it is sufficiently innocuous to be employed as a preservative in certain types of medicines, liniments, embrocations, dentifrices, &c.

### Commercial Utility

Isopropyl alcohol should find extensive use in the chemical industry as a dehydrating agent, especially for such materials as sugars, starches, proteins, gelatin and animal and vegetable tissues. Also for preserving histological specimens, and for cleaning and drying photographic prints, films and plates. Its great advantage is the ease with which it can be recovered in the anhydrous condition.

The closeness of boiling points of ethyl and isopropyl alcohols renders separation by straight distillation impossible and for this reason it has been used as a key denaturant in America for perfumes and barbers' supplies. In this country it has already found extensive use as a substitute for rectified spirit in perfumes—the "Avantine" of Messrs. Howards & Sons, being well known in this respect. Other suggested uses for this alcohol are as a surgical disinfectant, a filler for thermometers and as an "antifreeze" solution for motor-car radiators.

Because of its anhydrous nature isopropyl alcohol is a superior solvent to ordinary industrial methylated spirits, especially when its ease of recovery is considered, and the fact that its use is free from the restrictions imposed by the Excise Authorities thereon. A further advantage is that it is a pure substance unadulterated with colored, poisonous or odorous bodies. Thus it is admirably adapted for use in the manufacture of synthetic chemicals, for extractions, recrystallizations and the preparation of liquid and solid medicinal extracts. A further important use is as a precipitant for proteins and peptones, sugars, dextrins, gums and mucilages, soluble starch, glycero-phosphates, &c. It is superior to ether and acetone with respect to fire hazard.

Like other alcohols, isopropyl alcohol is a non-solvent for cellulose nitrates and acetates, but it is a "latent" solvent, *i. e.*, in the presence of a small quantity of an ester it becomes a perfectly good solvent. It can replace ethyl alcohol to advantage in nitro-cellulose lacquers, all alcohol soluble resins being equally soluble in isopropyl alcohol, which has superior "flowing" qualities whilst evaporating at nearly the same rate with freedom from "bloom." The absence of methylating agents, some of which have been demonstrated to have

a very deleterious effect on film strength, is a decided advantage. In the United States it is rapidly becoming the standard dehydrating and damping medium for nitro cotton, because of its already remarked superiority to ethyl alcohol, and to the fact that whilst giving practically as good flowing properties as butyl alcohol, it is a better resin solvent and much cheaper. If it is desirable to incorporate butyl alcohol in the formula, the presence of isopropyl alcohol renders an appreciable reduction in quantity possible. In order to obtain formula costs the following figures should be useful:

| | |
|---|---|
| Volume of 1 lb. isopropyl alcohol | 0.1282 Imperial gallons |
| equiavalent to ..... | 0.1539 U. S. gallons |
| 1 Imperial gallon weighs ..... | 7.99 lb. |
| 1 U. S. gallon weighs ..... | 6.497 lb. |

(1 U. S. gallon equivalent to 0.8831 Imperial gallons.)

Isopropyl alcohol is an excellent solvent for camphor and camphor substitutes and can be used in the preparation of plastics, dopes, lacquer films and collodion.

Isopropyl alcohol is a good solvent for shellac, dissolving shellac wax as well as the resin. It forms a more viscous varnish than ethyl alcohol. It is also a solvent for sandarac, kauri and mastic resins, also for common resin and bush kauri, whilst it is a partial solvent for elemi, copal and dammar. Its non-poisonous nature makes its use desirable in spirit varnishes for use on food containers.

Further suggested uses for this alcohol are for wood stains, flavoring extracts, as a constituent of paint and varnish removers, disinfectant and deodorant solutions and insecticides, for medicinal dressings and preparations and for dry cleaning.

## Derivatives

Isopropyl alcohol readily forms derivatives, the majority of which have only recently become known, and commercial uses for which have not yet been developed. They should, however, be none the less valuable.

Isopropyl acetate is probably one of the most important. It is a fragrant smelling liquid, boiling point 88.8° C., specific gravity 0.877 at 15.6°. It is an excellent nitro-cellulose solvent, evaporating quickly without any tendency to produce "bloom," and should find extensive use in pyroxylin lacquers.

Isopropyl chloride is a stable, non-corrosive and pleasant smelling liquid, boiling-point 36.5° C., specific gravity 0.866 at 15.6°. It is a good solvent for fats and although it can be ignited it is readily extinguished, hence it could replace with advantage carbon bisulphide and petroleum ether in fat extraction. It is a useful synthetic reagent. It could also be used in certain types of refrigerating machines.

Di-Isopropyl ether is a liquid with a sweet camphoroceous odor, boiling-point 68.5° C., specific gravity 0.732 at 15.6°.

Isopropyl esters of formic, butyric, valeric, benzoic and salicylic acids should find use in the perfumery and essence industries.

Acetone is obtained by the catalytic oxidation of isopropyl alcohol in good yields. This should be an additional source of supply should ever a shortage occur.

## Detection of Isopropyl Alcohol

The following is a good test for isopropyl alcohol (J. Rae, *Pharmaceutical Journal, June,* 1926):

Into a 200-c.c. flask, place 20 c.c. of a 1 per cent. aqueous solution of potassium bichromate, 1 c.c. conc. sulphuric acid, and 10 c.c. of the sample to be tested. The contents of the flask are distilled over a small flame using a bent glass tube as condenser, and about 3 c.c. distillate collected. 2 c.c. of a 5 per cent. sodium nitroprusside solution is mixed with an equal volume of 0.880 ammonia solution in a test-tube, and about 2 grams ammonium chloride added. The distillate is now carefully layered on to the surface and set aside for a few minutes. If acetone is present from the decomposition of isopropyl alcohol, a purple ring will appear at the junction of the liquids. Rectified spirit gives a negative test, although methylated spirit may give a positive reaction, due to traces of acetone in the methylating agent. This is tested for by giving a color with sodium nitroprusside without previous oxidation. The reaction is sensitive to 0.1 c.c. of the alcohol.

## Future Developments

In America, isopropyl alcohol was first marketed at the beginning of 1920. Since then, the only available production figures are those of 1922, a total of 256,868 lbs. At the present time, it is being produced in rapidly increasing quantities and transported and shipped in tank cars at a price equivalent to 6½d. per lb. Production figures

for this country and the Continent are not available, but the prices seems to be approximately 1s. 10d. per lb, for the Continental product, and 2s. 6d. per lb. for the English. At a price of 6½d. per lb., compared with 4½d. per lb. for methylated spirit, isopropyl alcohol is an economic solvent possessing advantages hardly rivalled by any other.

With the establishment of the petroleum refining industry in this country and the introduction of modern "cracking" plants, it is to be hoped that full use will soon be made of the gases there produced as a source of isopropyl alcohol and similar solvents, and so bring about a rapid lowering of prices to a level more consistent with those in America. At present, it is difficult to see how this can be done using acetone as the raw material, since the wood distillation industry in all countries is being brought to a standstill before the progress of synethetic methyl alcohol and acetic acid. Synthetic acetone could hardly compete as a raw product with waste gases. The only other possible source of cheap isopropyl alcohol might be from the by-product acetone and hydrogen produced in the manufacture of butyl alcohol by fermentation. It is, however, to the petroleum industry that one must look with the most confidence for the production of this and related solvents from inexpensive basic materials.

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# SCIENTIFIC AND TECHNICAL ABSTRACTS

SOLID HELIUM.—In July, 1926, preliminary notices of the solidification of helium were published in Nature and in Comptes Rendus. His successor had succeeded where Kamerlingh Onnes with his long experience with gases at low tempertures had failed.

Professor Keesom quite naturally desired to see solid helium and to this end replaced the capillary tube, which was opaque, being of metal, by a glass tube containing an iron stirring rod operated by an electro-magnet. Helium was compressed into this tube, the surrounding bath being at 13.3 m.m. mercury and 1.9° K. The stirrer was kept moving up and down while the pressure on the liquid in the tube was increased. "At a certain pressure the stirrer stuck; the helium had become solid. There was, however, nothing peculiar to be

seen in the tube. Solid helium is perfectly transparent." After other experiments it is said, "Again there is nothing peculiar to be seen in the helium; no surface of demarcation between solid and liquid, nor between solid and gas or between liquid and gas. There was no indication of difference in refraction, nor change of volume. Helium solidifies to a homogeneous transparent mass. That it is a crystalline mass, seems to follow from the fact that the melting curve is sharply defined." In one case there was a solid block of helium 15 to 20 m.m. long that was moved along the containing tube through a distance of some millimetres. Its motion was observable only by its effect on black particles in the liquid.—*Jour. Franklin Inst.*, Sept., 1927, p. 429.

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Facts Worth Knowing About Aluminum Paint.—Peculiar characteristics that help to solve some industrial painting problems. Aluminum paint has graduated from being a merely decorative product into one of increasing importance, industrially, because of its peculiar characteristics. Aside from being a paint, applied much as any ordinary paint is applied to a surface, the resulting film has certain unique qualities whose importance is only beginning to be understood.

What is the secret of the efficiency of these finishes? To a large extent it is directly traceable to the peculiar property of "leafing" which the particles of aluminum possess. In the manufacture of aluminum bronze powder, the pure aluminum is rolled out into very thin sheets and the minute particles of aluminum are pounded or stamped out of these sheets. They usually go through a "polishing" process, so that they possess a sheen. They are graded according to fineness, and are put up into various sized packages for sale. The leafing action is similar to the manner in which the scales of a fish overlap one another. In the proper vehicle the aluminum particles float to the top upon application and by the leafing action form a smooth, continuous film, usually of wonderful durability. At the same time the finished film possesses unusual hiding power, so that one coat of aluminum paint will frequently cover solidly over a black undercoat. This is only true, however, if the product is kept well stirred during application, so that there will be sufficient of the powder in suspension to give proper hiding.—*Industrial Management*, June, 1927, p. 355.

EFFECT OF VARIOUS PIPE METALS ON WATER.—Results of experiments undertaken in an endeavor to ascertain the cause of corrosion in water pipes and fittings indicate that whatever pipe is used a certain amount of metal will be taken into solution by the water and this amount varies under different conditions and with different waters.

Galvanizing an iron pipe prevents to a large extent the absorption of iron, but zinc is taken into solution as long as the galvanizing lasts. Brass pipe yields a large quantity of zinc, but generally only small amounts of copper. Copper pipe yields only about the same amount of copper as brass pipe, but zinc is not involved in the corrosion of these pipes except occasionally.—*Elec. World,* Aug. 6, 1927, p. 273.

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ELECTROLYTIC STERILIZATION OF DRINKING WATER.—The authors propose sterilization by electrolysis using a sufficient anodic density. The resistance of drinking water being rather high, the necessary density is obtained by causing a high potential difference to act at the terminals of the electrodes. In practice 110 to 120 volts give excellent results. Passage of current under these conditions produces chlorine from alkaline-earth chlorides, also hypochlorites from the electrolysis of alkaline chlorides contained in the water, and in addition ozone is produced by the condensation of oxygen on the anode. The anode consists of a thin platinum wire, the cathode of a large cylinder of bronze or other metal, coaxial with the anode. This process destroys all bacteria and other organic matter and gives the water the power of killing bacteria afterward to a certain extent.—*Le Genie Civil,* July 30, 1927, p. 128.

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DETERMINATION OF CARBON MONOXIDE IN FLUE GASES.—The author has developed a method in which the CO is determined colorimetrically. He has somewhat modified the Orsat apparatus and uses a solution of ammoniacal silver nitrate (Thiele) in two pipettes (Wilhelmi) of 90 and 110 cu. cm. The smaller pipette is used when carbon dioxide and oxygen are first to be determined, the larger one when CO alone is to be measured. A vacuum is first produced in the pipette with a water jet pump, sucking in ammoniacal silver nitrate

as far as the 10 cu. cm. graduation, after which the gas in the burette is drawn in. The pipette is then quickly disconnected from the hose and shaken. The time in seconds, elapsing from beginning of shaking to first visibility of darkened color, gives a measure of the CO content in per cent. and can be read from a curve previously established by similar tests on known mixtures.—*Das Gas- und Wasserfach,* May 28, 1927, p. 515.

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TRANSMUTATION.—Once more have the Scientific American's transmutation experiments been confirmed. Dr. L. Thomason, of the California Institute of Technology, has just duplicated the methods employed by Smits and Karssen, two Dutch physicists who believed, nearly two years ago, that they had successfully transmuted lead into mercury. No results.

Last February Dr. M. W. Garrett, an English scientist, reported to the Royal Society that his attempt to transmute tin into indium by the same method was a failure.

A few months ago the noted German chemist, Dr. Fritz Paneth, came to the conclusion that his apparent former success in transmuting hydrogen into helium was without question a mistake, the trace of helium found having come from the glass vessel itself.

Two years ago Prof. Sheldon, Corresponding Editor of the Scientific American, conducted for this journal a duplication of the famous original transmutation experiment of the German, Prof. Miethe. No result.

Quite naturally we are pleased every time someone else confirms the Scientific American tests. Evidently the atom is having the last laugh.—*Scientific American,* Aug., 1927, p. 99.

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NATURE AS OIL MAKER—The theory that the natural formation of petroleum is a thing of the past has been shaken by Dr. Hans Tropsch of the Kaiser Wilhelm Institute, Manheim-Ruhr, Germany.

Nature's probable methods in making petroleum are duplicated in the recent discovery of the method of its synthesis from water gas, he said. Liquefaction of coal by the Bergius process is strictly limited to bituminous coal and lignite, but the newly discovered process has no such limitation.

"Any of the ordinary fuels, whether of high or low grade, can be

converted into gases," Dr. Tropsch declares. "Either water gas, a mixture of hydrogen and carbon monoxide obtained by heating carbon in a current of steam, or natural gas such as methane, ethane and others. Either natural gas or water gas can be used as a starting point for the preparation of gasoline, naphtha, lubricating oil or paraffin wax by recently discovered catalytic processes. These processes are similar to those in operation in Germany, France and the United States for producing wood alcohol, formerly made exclusively from wood, and in Germany for the manufacture of 'synthol,' which is proving satisfactory as a motor fuel."

Dr. Tropsch pointed out that in the industrial production of synthol, or synthetic gasoline, no refining process of any sort is necessary. In the present petroleum practice, the removal of sulphur from gasoline has been estimated to have cost American motorists about $50,000,000 per year.

Following his summary of the processes in the graduation of synthetic gasoline, Dr. Tropsch concluded:

"There are, therefore, indications existing from which we can conclude that at least part of the natural crude oil was formed inorganically with the help of catalysts. From this possibility we may conclude that even today, under favorable conditions, crude oil is formed other than from animal residues."—*Aera,* August, 1927, p. 101.

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# NEWS ITEMS AND PERSONAL NOTES

THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE OPENED SEPTEMBER 23 WITH THE LARGEST ENROLLMENT IN ITS HISTORY, COMPRISING STUDENTS FROM 38 STATES AND SEVERAL FOREIGN COUNTRIES.—At the regular meeting of the Trustees of the College, on September 26, Dr. Wilmer Kreusen was formally elected President. The following Trustees were re-elected to serve for a three-year period: Walter V. Smith, Dr. George D. Rosengarten, Dr. Robert Shoemaker and Dr. Charles H. La Wall.

The new buildings of the college are now rapidly nearing completion and will be occupied by the present classes in January next.

A Book of Achievement—A recent mail brought us a copy of an unusual booklet which, although it is intended for advertising, would hardly be recognized as such, so dignified is it in typography and general appearance.

"For the Conservation of Life" is the title of this booklet, which will be recognized by many as the slogan of a well-known manufacturer of biological and pharmaceutical products, and, after reading the booklet, one is impressed with the fact that this slogan is a serious reality with this firm, and not merely a high-sounding phrase.

The booklet records some of the more important activities which have been carried on by the Mulford Laboratories with the aim and purpose of adding years to the average span of human life.

The achievements recorded therein are notable—some are epoch-making—and the reader is soon impressed with the vast amount of pioneering that these Laboratories have done.

We heartily commend this booklet to your attention, and if you have not received a copy we suggest that you write to H. K. Mulford Company, Philadelphia, Pa., and mention this Journal.

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# BOOK REVIEWS

Standards and Tests for Reagent and C. P. Chemicals. Benjamin L. Murray. Second Edition. Revised and enlarged. 8 vo., xiii-560 pages. D. Van Nostrand Co., N. Y. $5.00.

A fellow student of the reviewer once asked in humorous mood if C. P. stood for "cimon pure." In earlier years it was rather vague, indicating little more than a moderate degree of purity, something better than the commercial grade. Chemistry, however, is an exact science and the progress in the last half century has been predominantly towards minute accuracy and certainty. Today we have an abundant supply of reagents that Susannah Centlivre might call the "real Simon Pure." These come to the chemist not only freed from impurities that would render analysis inaccurate, but with indications of minute amounts of such substances may not be specially objectionable yet about which the user desires information.

The introduction of standard methods of analysis and the manufacture of analyzed chemicals are two of the most encouraging fea-

tures of practical chemistry. Nevertheless, analysts will feel frequently the necessity of checking up the data furnished on the label and the work in hand will serve perfectly. Tests for reagents were scattered through journals and text-books and it was difficult to get checking methods on many points. In 1870 Krauch, under the auspices of a firm manufacturing reagents, collected a large amount of information and published it in book form. As a pioneer in this field his book should be duly appreciated.

In preparing the second edition of the present work, two phases have been considered. First, the revision and improvement of the standards and tests for the reagents; second, the introduction of much entirely new materials for c. p. chemicals. Concerning the term c. p. the author states that there is no satisfactory agreement between consumers, dealers and manufacturers as to its significance. A distinction is made between reagent grades and c. p. grades, the former, of course, comprising the stricter examination and the closer limits of impurity.

The book is very comprehensive, covering all classes of reagents and undoubtedly will be of great use in the analytical as well as in the works lavoratory. Constant supervision of chemicals and procedures is the price of accuracy and certainty. The book is well printed in clear type and very convenient for use. There is a good index but no table of contents. In a work dealing with so many separate items not specially classifiable into great groups, a table of contents is not much needed. It is with pleasure that the reviewer notes that $C_6H_6$ is termed "benzene." The disposition of English-speaking chemists to call this important and characteristic hydrocarbon by a name indicating an alcoholic structure is depressing. Inasmuch as accuracy in practical work is now the goal, accuracy nomenclature should also be inculcated.

HENRY LEFFMANN.

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THE MYSTERY AND LURE OF PERFUME. By C. J. S. Thompson. With 26 Illust. 247 pp. J. B. Lippincott Co., Philadelphia.

The author of the book before us, as well as of "Mystery and Romance of Alchemy and Pharmacy," of "Poison Mysteries in History, Romance and Crime," and of "The Mysteries and Secrets of Magic," is well-known in pharmaceutical circles throughout the world. He was Curator of the Wellcome Historical Medical Museum in

London and is now with the Royal College of Surgeons of England.

Perfumes have had a peculiar attraction for mankind and especially women, from a period of great antiquity and the subject is one of profound interest. From the twenty-two chapters the referee begs to call attention to the following: I. The First Garden of Flowers; II. Perfumes used by Early Civilized Races; VII. Perfumes used by the Ancient Greeks; VIII. Perfumes of Roman Times; IX. Spicers of London; XII. Perfumes of the 16th and 17th Century; XV. Perfumed Waters; XVIII. The Making of Perfumes. Among the twenty-six illustrations I want to point out the following: The Origin of Perfumes; Laboratory of an Arab Perfumer; Roman Perfume Bottles; Distilling Lavender; The Card of an Old London Perfumer; The Toilet of an Egyptian Princess.

Dr. Thompson's new book should prove useful not only to the student of the history of perfumes, but to pharmacists and chemists in general. We wish the work the best of success.

OTTO RAUBENHEIMER, Ph. M.

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FORMULÆ MAGISTRALES GERMANICÆ. Im Auftrage des Deutschen Apotheker—Vereins bearbeitet von Prof. Dr. L. Lewin. 2. verbesserte und sehr vermehrte Auflage. 1927 Selbstverlag des Deutschen Apotheker-Vereins, Berlin.

The object of this handy, pocket volume of 128 pages, is to get physician and pharmacist acquainted with Magistral Formulas, prescriptions which have been used with success and which are superior to the new specialties under euphonious or trade-mark names. Here we find the formulas of the old master physicians and pharmacists, prescriptions so old that they are frequently forgotten, as, for instance, Hufeland's Anticatarrhal Elixir, Sedative Pills, Tooth Powder and Purgative Tea; Hebra's Itch Ointment and Tinct. Rusci; Burow's Aqua Gingival; Hager's Anticatarrhal Pills, etc.

The prescriptions are classified according to their therapeutic action, namely: Nervina, Alterantia, Antiseptica, Uterina, Cardiaca, Diaphoretica, Expectorantia, Stomachica, Purgantia, Dermatica, etc. Full directions, or further particulars as to caution notices are given under each formula.

The Deutsche Apotheker-Verein deserves credit for publishing

this book and for its compilation by such an authority as the pharmacologist Prof. Dr. Lewin.

OTTO RAUBENHEIMER, Ph. M.

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BADISCHE VOLKSHEILKUNDE. Von Walther Zimmermann. 110 pp. Verlag C. F. Mueller, Karlsruhe.

The monograph before us is by an authority of this subject, The Historian of the Gesellschaft fuer Geschichte der Pharmazie. He presents here the folklore and domestic treatment of all kinds of ills and diseases in his native land "Baden" in the southwestern corner of Germany. To make the book complete the diseases and treatment of domestic animals is also included. The author who is chief apotheker in a large hospital and sanitarium is to be complimented on this publication!

OTTO RAUBENHEIMER, Ph. M.

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MUENCHEN'S AELTESTE APOTHEKE. Bearbeitet von Fritz Ferchl, Mittenwald. 61 pp. Wissenschaftl. Verlagsgesellschaft, Stuttgart.

Munich, the capital of Bavaria, is not only noted for its excellent beers, but also for one of the oldest pharmacies in Europe namely the "Schuetzen-Apotheke," dating back to 1398. In its present location since 1863, it has entrances on two prominent streets, near the railroad station. The writer was fortunate to visit this historic pharmacy during his European trip and was also pleased to call on the author of the book before us, and, at the same time, see snow on the Karwendel Mountains on August 9, 1926. Fritz Ferchl is also the author of the "Apotheker-Kalender" and is well known for his researches in historical pharmacy, being one of the charter members of the Society for History of Pharmacy. The illustrations are works of art.

OTTO RAUBENHEIMER, Ph. M.